THE MARINERS NEW Kalendar.

Containing

The Principles of Arithmetick and Geometry; with the Extraction of the Square and Cube Root. Also Rules for finding the Prime, Epact, Moons-Age, Time of High-Water; with Tables for the same.

Together with

Exact Tables of the Suns Place, Declination, and Right Ascension. Of the Right Ascension and Declination of the Principal Fixed Stars. Of the Latitude and Longitude of Places. A large Table of Difference of Latitude and Departure for the exact Working a Traverse.

ALSO

The Description and Use of the Sea-Quadrant, Forestaff and Nocturnal. The Problems of Plain Sailing and Astronomy, Wrought by the Logarithms and by *Gunter's* Scale. A Rutter for the Coasts of *England*, *Scotland*, *Ireland*, *France*, &c. And The Soundings coming into the Channel. With Directions for Sailing into some Principal Harbors.

The third Edition.

By NATH. COLSON *Student in the Mathematicks.*

London, Printed by *J. Darby* for *William Fisher*, at the *Postern-Gate* near *Tower-Hill*; *Robert Boulter*, at the *Turks-Head*, and *Ralph Smith*, at the Bible in *Corn-Hill*, near the *Royal Exchange*, 1677.

TO THE

Ingenious Mariner.

I *Here preſent thee with a* NEW KALENDAR, *wherein I have endeavoured not to puzzle thee with unprofitable Problems, (a thing too much practiſed) but to make things plain and practicable. Here's nothing obſcure or difficult to diſcourage young beginners, (for whom 'tis intended) but all things treated of with as much plainneſs, both of Matter and Method, as poſſible: And I aſſure thee, were I preſent to inſtruct thee, I could by no means render things more intelligible than I have here done. I have endeavoured to omit nothing that might be materially uſeful, having reſpect to the deſigned bigneſs of the Volumn: The Contents are as follow,*

The Principles of Arithmetick, (with which I begin, becauſe I am ſenſible of the loſs ſome have been at, that have attempted Navigation before they have underſtood ſomething of it); The Extraction of the Square and Cube Root, in all which I have endeavoured to apply the Examples to Sea-Affairs. Some neceſſary Geometrical Problems, uſeful in Navigation. Directions for finding the Prime, Epact, Moons-Age, and the time of Full Sea, (both according to the ordinary and a more accurate way) with Tables for the ſame. Tables of the Suns Place and Declination, with Directions and Examples in every caſe how to uſe the Declination to find the Latitude: As alſo a neceſſary Table for correcting the Declination, when the Difference of Longitude is conſiderable from the Meridian of

London, *for which the said Tables of Declination are Calculated. A Table of the Suns Right Ascension. A Table of the Right Ascension and Declination of some of the Principal Fixed Stars: With the use of the said Tables in finding the time of a Stars coming to the Meridian, as also Directions at large for Observation of any of the said Stars to find the Latitude of the Place, with Examples in each Case. The Description and Use of the Sea-Quadrant, Foreſtaff, and Nocturnal. A Table of Latitude and Longitude of the Principal Places on the Sea-Coast, collected from the Best Informations. Problems of Plain-Sailing and Astronomy, which (that the Practitioner might learn two things at once) are wrought both by the Logarithms and* Gunter's *Scale. A large and very useful Table of Difference of* Latitude and Departure, *to every Degree and Quarter-Point of the Compass: With its Use in working a Traverse, in order to keep a Reckoning at Sea. A Rutter for the Coast of* England, Scotland, France, Ireland, Spain, Portugal, *&c. shewing the Bearing and Distance from one Place to another. A Table of the Soundings coming into the Channel, giving the* Depth of Water and Quality of the Ground. Lastly, *Directions for Sailing into some Principal Harbours. By all, or any of which, if thou art any ways profited, (as I know thou mayest, if thou wantest information in any of these things, and dost but a little carefully animadvert upon what thou readest) I have my end, and thy kind acceptance hereof will farther oblige me,*

Who am thy Frind,

NATHANIEL COLSON.

THE

THE Mariners New Kalendar.

The Principles of Arithmetick *briefly and plainly demonstrated. With the Extraction of the* Square *and* Cube Roots.

BEcause of the Usefulness, and indeed Necessity of some knowledg of *Arithmetick* in the Art of *Navigation*; it is requisite to begin with that, without which no orderly procedure can be made; and first of

Numeration.

NUmeration is that part of *Arithmetick*, whereby one may rightly express the value of any Number proposed.

All Numbers are expressed by these Characters following:

1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Cipher.

Although *Ciphers* signifie nothing by themselves, yet being put before (or to the right hand of) other Figures, they increase their value as much as if they were all Figures, as may plainly be seen in the Table following.

1	Unites	1
12	Tens	10
123	Hundreds	100
1234	Thousands	1000
12345	X. Thousands	10000
123456	C. Thousands	100000
1234567	Millions	1000000
12345678	X. Millions	10000000
123456789	C. Millions	100000000

Figures have their value according to the places they are set in; As 1 in the first place, or place of *Unites*, is *One*; In the second place, *Ten*; in the third place, *One Hundred*; In the fourth place, *One Thousand*; In the fifth place, *Ten Thousand*, &c.

The

The Table directs how properly to expreſs any given Numbers; As 123, which Number conſiſting of three places is thus numbered, *One hundred twenty three*; and this number 123456, conſiſting of ſix places, is thus expreſſed, *One hundred twenty three thouſand, four hundred fifty ſix*; and this number 123456789, conſiſting of nine places, is thus numbered, *One hundred twenty three Millions, four hundred fifty ſix Thouſand, ſeven hundred eighty nine.*

Addition.

Addition is that which of ſeveral ſums makes but one Sum.

Example.

Suppoſe four Men (A. B. C. D.) owe me ſeveral Sums of Money, and I would know how much is due to me in the whole; I begin at the firſt row towards the right hand, and ſay, 3 and 6 is 9, and 2 is 11, and 4 is 15; ſetting down the 5 under the row added up: then I carry the 1 ten to the next row, ſaying, 1 and 4 is 5, and 5 is 10, and 3 is 13, and 6 is 19; ſet down 9 under the row added up, and carry the 1 to the next row, ſaying, 1 and 8 is 9, and 1 is 10, and 4 is 14, and 5 is 19; ſet down 9, and carry 1, which 1 and 1 is 2, and 3 is 5, and 5 is 10, and 3 is 13; which becauſe this is the laſt row I ſet down: ſo that by this Addition the whole Debt is found to be *Thirteen thouſand, nine hundred ninety five Pounds.*

	l.
A. oweth	3564
B. ——	5432
C. ——	3156
D. ——	1843
——	13995

Characters uſed in Arithmetick.

l. Pounds.
s. Shillings.
d. Pence.

° Degrees.
′ Minutes.
″ Seconds.

Example 2.

Suppoſe I have ſeveral Creditors to whom I owe ſeveral Sums of Money, I deſire to know the who'e.

Therefore beginning again (as always in *Addition*) at the right hand, I ſay, 11 and 10 is 21, and 4 is 25, and 6 is 31; now conſidering how many ſhillings there is in 31 *d.* I find 2 *s.* and 7 *d.* wherefore I ſet down the odd 7 *d.* under the row of Pence, and carry the 2 *s.* to the next row, being

l.	*s.*	*d.*
33	11	06
55	09	04
36	08	10
103	04	11
228	14	07

Shillings,

Shillings, saying, 2 and 4 is 6, and 8 is 14, and 9 is 23, and 11 is 34; that is 1 *l.* 14 *s.* set down 14 *s.* and carry the 1 *l.* to the next row, saying, 1 and 3 is 4, and 6 is 10, and 5 is 15, and 3 is 18; set down 8 and carry 1; then 1 and 3 is 4, and 5 is 9, and 3 is 12; set down 2 and carry 1; lastly, 1 and 1 is 2: So that by this Addition the whole Debt is, *Two hundred twenty eight pounds, fourteen shillings and seven pence.*

Example 3.

Suppose at Sea keeping my Reckoning in Degrees and Minutes, having six days difference of Longitude, I would know how much the whole is.

Say, 13 and 2 is 15, and 9 is 24, and 56 is 80, and 6 is 86; now 60 minutes making a degree, set down the odd 26 min. under the row of minutes, and carry the 1 deg. to the next row, being degrees, saying, 1 that I carry and 1 is 2, and 1 is 3, and 2 is 5, and 1 is 6, and 1 is 7. So that the whole difference of Longitude made these six days is 7 degrees and 26 minutes.

		°	′
1 day.		1	06
2	——	0	56
3	——	1	09
4	——	2	00
5	——	1	02
6	——	1	13
		7	26

Substraction.

Substraction is the taking of a less Sum out of a greater, subscribing the Remainder.

Example.

	l.	*s.*	*d.*
Suppose a Man owed me ——	376	13	06
And hath paid me ——	211	05	08
I desire to know what remains unpaid, which is, —	165	07	10

To work this, I say, 8 from 6 I cannot, but considering there is twelve pence contained in a shilling, I add 12 to the 6, and say, 8 from 18 and there remains 10, which set down under the pence; and then having borrowed 1, I go to the next row, and say, 1 that I borrowed and 5 is 6, which taken out of 13 there remains 7; then proceeding to the pounds, I say, 1 from 6 there remains 5, and 1 from 7 there remains 6; and lastly, 2 from 3 there remains 1. So there remains due of the said Debt, *One hundred sixty five pounds, seven shillings, ten pence.*

Example

Example 2.

Suppose the distance between two places to be 1000 Miles, and that I have sail'd 396, and I desire to know how many miles I have to sail.

Therefore placing 396 under the 1000, I say, 6 from 0 I cannot, but 6 from 10 there remains 4; proceeding to the next figure, I say, 1 that I borrowed and 9 is 10; from 0 I cannot, but 10 from 10 there remains 0; again 1 that I borrowed and 3 is 4; from 0 I cannot, but 4 from 10 there remains 6; lastly, 1 that I borrowed from 1, there remains 0. So there remains to sail, 604 miles.

Miles.
1000
396
604

Example 3.

Suppose one place in the Latitude of 51 deg. 32 min. and another in the Latitude of 42 deg. 10 min. I would know the Difference of Latitude between them.

To do which, subtract the less Latitude out of the greater thus; the lesser being placed undermost, say, 10 from 32 there remains 22, which place under the minutes; then for the degrees, 2 from 1 I cannot, but 2 from 11 there remains 9, then 1 that I borrowed and 4 is 5, from 5 there remains 0. So the Difference of Latitude is 9 *deg.* 22 *min.*

°	′
51	32
42	10
09	22

Multiplication.

Multiplication is that which serves instead of many Additions, by which any number of a greater denomination is brought into a less, as Pounds into Shillings, and Shillings into Pence, and Pence into Farthings, Degrees into Minutes, Minutes into Seconds, and the like; which is done by multiplying the Number of the greater Denomination, by the Number of the lesser which is contained in the greater, as the multiplying any number of Pounds by 20 (the number of Shillings contained in a Pound) brings it into Shillings: And so of the rest.

Multiplication consists of three parts.

1. The Multiplicand, or number to be multiplied.
2. The Multiplyer, or number by which to multiply.
3. The Product made by the Multiplication.

For the Learners more ready procedure herein, it is necessary to insert the Table, which is first to be committed to Memory. *The*

The Multiplication Table.

2 times	2	4	5 times	5	25
	3	6		6	30
	4	8		7	35
	5	10		8	40
	6	12		9	45
	7	14			
	8	16	6 times	6	36
	9	18		7	42
				8	48
3 times	3	9		9	54
	4	12			
	5	15	7 times	7	49
	6	18		8	56
	7	21		9	63
	8	24			
	9	27	8 times	8	64
				9	72
4 times	4	16	9 times	9	81
	5	20			
	6	24	10 times	10	100
	7	28			
	8	32			
	9	36			

Example 1.

I demand how many ſhillings there is in 5648 *l.*

To anſwer this, Multiply the given Number of Pounds by 20, thus, The firſt being a Cipher, ſet down 0 underneath the firſt Figure; then proceed to the next figure, and ſay, 2 times 8 is 16; ſet down 6 under the ſecond figure, and carry 1; then 2 times 4 is 8, and 1 that I carried makes 9; then 2 times 6 is 12, ſet down 2 and carry 1; laſtly, 2 times 5 is 10, and 1 that I carried makes 11. So that 5648 *l.* multiplied by 20, makes 112960 ſhillings.

l.
5648
20
112960

Example 2.

In 276 Degrees, how many Minutes?

First ſet down	276
Then multiply by	60
Becauſe 60 Minutes makes a Degree.	
	16560

So that I find 276 degrees multiplied by 60 makes 16560 minnutes.

Example 3.

Multiply	8765437	Multiply	47632867
By	32	By	4352
	17530874		95265734
	26296311		238164335
Product	280493984		142898601
			190531468
			207298237184.

Diviſion.

Diviſion is that which ſerves in the room of many *Subtractions*, and is uſeful in reducing of all Numbers of a leſſer denomination into greater, as Minutes into Degrees, Farthings into Pence, Pence into Shillings, and Shillings into Pounds. It conſiſts of three parts, (*viz.*) Dividend, or the Number to be divided; Diviſor, or the Number to divide by; and the Quotient, with the Remainder after Diviſion.

Example 1.

To divide 7834 by 23; firſt ſay, How many times 2 in 7? or how often 23 in 78? The Anſwer will be 3 times, which place in the Quotient; then multiply the Diviſor 23 by 3, the figure placed in Quotient, ſaying, 3 times 3 is 9, and 3 times 2 is 6, and place theſe under the two firſt figures of the Dividend, and draw a Line; ſubtract 69 from 78, and there

Diviſor.	*Dividend,*	*Quotient.*
23	7834	340
	69..	
	93	
	92	
	14 Remains.	

there reſts 9, which ſet underneath, and place a point under 3 to ſhew that it is brought down; place it to the 9, then proceed, ſaying, How many times 23 in 93? or how many times 2 in 9? which will be 4 times; place 4 in the Quotient, by which multiply the Diviſor; again placing the Product, which is 92, under 93, and draw a line, and ſubtracting it therefrom; the remainder 1 put under the Line, and ſet down 4, the laſt figure in the Dividend, putting a point under it, and place it to the remaining 1: Then becauſe there remains but 14, being leſs than the Diviſor 23, and ſo cannot be taken out of it, place a Cipher in the Quotient, and the Work is finiſhed.

Example 2.

In 360 Minutes, how many Degrees? Here I divide by 60, becauſe 60 minutes make a degree; and becauſe 6 cannot be taken out of 3, therefore I ſay, How many times 6 in 36? The anſwer is, 6 times: which I place in the Quotient, and proceed to multiply the Diviſor by the 6 placed in the Quotient, which produceth 360; which ſubtracted, leaves 0. So that by this Work it appears that in 360 Minutes there are 6 Degrees juſt.

Diviſor.	*Dividend.*	*Quotient.*
60	360	6
	360	
	00	

Example 3.

A Ship taken by 253 Men, is valued at 59875 *l.* I demand each Mans ſhare being equally divided.

Diviſor.	*Dividend.*	*Quotient.*
253	59875	236
	506..	
	927	
	759	
	1685	
	1518	
	167 Remains.	

236	
253	
708	
1180	(7
472	(6
	(1
59875	
Proof.	

Firſt ſay, How many times 2 in 5? the anſwer is, two times; which place in the Quotient; then multiply the Diviſor 253 by 2 the

figure placed in the Quotient, saying, 2 times 3 is 6, 2 times 5 is 10; set down 0 and carry 1; 2 times 2 is 4, and 1 is 5; which set down under the three first figures of the Divisor, from whence being subtracted, set the Remainder underneath, which will be 92; then take down 7, making a point underneath, and set it after 92 the Remainder; then say, How often 2 in 9? answer, 3 times, (for 4 times will prove too many) Then multiply the Divisor 253 as before by 3, the figure last placed in Quotient, and the Product will be 759, which being subtracted from the figures above, the Remainder will be 161; then take down 5 and point it as before, setting it after 168, the last Remainder; and again ask the Question, how often 2 is contained in 16? Answer, 6 times; by which 6 when set in the Quotient, multiply the Divisor 253, and the Product is 1518, which place under the last Dividend, and subtracted there-from, there will remain 167. So that being no more figures to bring down, the Work is finished, each Mans share being 236 *l.* and 167 *l.* over, which is to be divided among them; which may easily be done by multiplying 167 by 240, and dividing the Product by 253, gives each Man's Share in Pence. The Proof is by multiplying 253 the Divisor by 236 the Quotient, and taking in 167 the Remainder, the Product will make the same with the Dividend, as it is wrought in the foregoing Page.

The Rule of Three.

THe *Rule of Three* is that by which having three Numbers given, a fourth Number is found in proportion thereunto; which is done by multiplying the second and third Numbers together, and dividing the Product by the first, and the Quotient of the said Division is the Answer to the Question.

Example.

Example 1.

If in 24 hours a Ship ſails 130 miles, How many miles will ſhe ſail with the ſame Gale in 192 hours, or eight days?

130.
192
5760
24)24960(1040 miles in 192 hours.
24...
096
96
00

Here 24 is accounted the firſt Number, 130 the ſecond, and 192 the third; wherefore according to the Rule I multiply 130 and 192, the ſecond and third numbers together, and divide the Product thereof 24960 by 24 the firſt Number, which gives in the Quotient 1040 miles, which is the way the Ship will make in 192 hours, the time propoſed.

Example 2.

If 1 ℔ of Tobacco coſt 6 *d.* what ſhall 112 ℔ coſt?

6
)672 pence (or 56 ſhillings.

Here the firſt number being an Unite, which neither multiplies nor divides, it ſaves the labour of the diviſion, and the anſwer is 672 *d.* (for the anſwer will be of the ſame name with the ſecond number) which divided by 12 to bring them into ſhillings, gives in the Quotient 56 *s.* which is the price of 112 ℔, as was required.

Example 3.

If a Staff of 2 Yards long give a Shadow of 3 Yards; How high is that Caſtle whoſe ſhadow is 100 foot?

Which queſtion for the more ready ſolution, ſtate thus.

If 6 foot (which is 2 yards) give 9 foot, What ſhall 100 foot give?

9
6)900(150 foot.
6..
30
30
00

By the Operation it appears the ſaid Caſtle muſt be 150 foot high.

Example

Example 4.

If 564 *l.* 12 *s.* 6 *d.* is to be divided between 165 Men, How much is one Mans ſhare? State it thus:

If 165 Men have 564 *l.* 12 *s.* 6 *d.* What ſhall 1 Man have?

20
11292
12
22590
11292
165)135510(821 pence.
1320..
351
330
210
165
45

12)821(68 ſhillings.
72.
101
96
005 pence

Note, that in the *Rule of Three*, the firſt and third numbers muſt be both of one Denomination, and the ſecond muſt be brought into the loweſt value expreſſed therein, as in the foregoing Example. I work not the queſtion as it was firſt ſtated; but tranſpoſing the numbers, I put the denomination of Men firſt and laſt, and the Money in the midſt to anſwer to that part of the Rule which requires the firſt and third numbers to be both of one name. Again, becauſe in the ſecond number Pence are expreſſed, I therefore bring the whole Sum into pence, which anſwers to the other part of the Rule, which requires the ſecond number into the loweſt value. The Anſwer therefore to the preceding Queſtion, as by the Operation appears, is 821 pence; which reduced into ſhillings, is 68 *s.* and 5 *d.* or 3 *l.* 8 *s.* and 5 *d.* which is one mans ſhare, as was required.

The next thing I ſhall briefly treat of, is, *The Extraction of the Square and Cube Roots*, as alſo ſomewhat of their uſe.

The

The Extraction of the Square Root.

Example 1.

TO extract the Square Root of 7056, proceed thus. First, point the given number (that is, put a prick) over every other figure, beginning at the first figure on the right hand, (and note by the way, that so many Points as the said number admits over it, of so many figures consists the Root of the said number) then proceed seeking the greatest square number (which is a number multiplied by it self) in the first point towards the left hand (70) which is 64 constituted of 8 multiplied into it self; for 8 times 8 is 64. The Root of this Square Number, which is 8, place in the Quotient, and subscribe the Square Number (64) under the said first point, subtracting it therefrom, and setting down the Remainder (6) underneath; to this Remainder bring down the next point (56); then drawing a crooked line on the left hand of the Dividend (656), double the Quotient, and place it (*viz.* 16) therein, calling it the Divisor; seek how often this Divisor is contained in all the figures of the Dividend, save the last to the right hand, (*viz.*) How many times 16 in 65? the Answer is, 4 times, which place in the Quotient, and also on the right hand of the Divisor (16), then multiply the Divisor (164) by the 4 last placed in the Quotient, and put the Product, which is 656 under the Dividend, subtracting it there-from; which done, nothing remains. So that the Square Root of 7056 is 84.

	. . Root
	7056 (84
	64
164)	656 Div.
	656
	0

The Square Root is applied to Navigation as follows.

Any two sides of a Right-angled Plain Triangle being given, the third is found by the Extraction of the Square Root.

Example 2.

Suppose a Ship to have made 87 miles Difference of Latitude, and 71 miles Departure, and the Distance to be required; The said Distance is found by the Extraction of the Square Root, as follows.

The

The Rule.

Square the Difference of Latitude and Departure ſeverally, (that is, multiply each by it ſelf) and from the Sum of both their Squares added together, extract the Square Root, which will be the Diſtance required.

Example 1.

Difference of Lat. is 87. The Departure 71. Square Diff. Lat. 7569.
Multiplied by it ſelf 87. Multip. by it ſelf 71. Square Depart. 5041.

609 71 Sum 12610
696 497
The Square 7569 The Square 5041

12610 (112 the Diſtance required.
1
21)026
21
222)510
444
66

By this Operation it appears, that the Diſtance omitting the Fraction is 112 miles.

Example 2.

Suppoſe a Ships Diſtance to be 111 miles, and her Departure 57 miles, and the Difference of Latitude to be required; the ſaid Difference of Latitude is found alſo by the Extraction of the Square Root, as follows.

The Rule.

From the Square of the Diſtance ſubtract the Square of the Departure, and the Square Root of the Remainder will be the Difference of Latitude required.

Example.

Example.

The Distance	111	The Departure	57
Multiplied by it self	111	Mult. by it self	57
	111		399
	111		285
	111	Sq. of Depart.	3249
Square of the Distance	12321		
Square of Depart. subtract.	3249		
Remains	9072		

9072 (95 Diff. Lat. required.
81
185) 972
925
47

The Difference of Latitude, as by the Operation appears, is 95 miles, omitting Fractions.

If the Departure be required, the Rule is this, (*viz.*) From the Square of the Distance, subtract the Square of the Diff. Lat. and the Square Root of the Remainder is the Departure required; the Operation for brevity sake is omitted.

Having proceeded thus far in shewing the Practitioner how to find the Distance, Difference of Latitude or Departure, without the Operations by the Logarithms, I shall (because of its pertinency in this place) shew the manner of finding the Course also without the said Logarithmical Operation, which is done (without sensible error) as follows.

The Proportion to find the Course.

As the Sum of the Hypothenuse (or Distance) and half the greater of the other two Legs, (*viz.* if the Difference of Latitude be most, half that; but if the Departure be most, half that); I say, as the sum of these two being added together, is in proportion to the lesser (or remaining) Leg, so is 86 to the Angle opposite to the less Leg; which is the Course, when the Departure is less than the Difference of Latitude, otherwise 'tis the Complement of the Course.

Example.

Admit a Ships Distance to be 112, the Difference of Latitude to be 88, and the Departure 69, and the Course to be required.

First, Add the Diſtance, and half the greater Leg into one Sum.

The Diſtance is ——————— 112
Half the greater Leg (88) is ——— 44
The Sum ——————————— 156

Having thus done, ſay by the Rule of Three:
As the ſaid ſum 156 to 69 the leſſer Leg, ſo is 86 to the Courſe.

To bring out the odd minutes, multiply the remainder of the Diviſion (6) by 60, (the number of minutes contained in a degree) and divide the Product by the Diviſor (156), and the Quotient of the ſaid Diviſion gives for the anſwer 2 minutes. So that the Courſe required is 38 *deg.* 2 *min.*

69
774
516
156)5934(38 *deg.* 2 *min.*
468.
1254
1248
6

Example 3. *Of the Extraction of the Square Root.*

Suppoſe a Rope of 5 inches compaſs, and another Rope of double the ſtrength is deſired. The Dimenſions of the ſaid required Rope is found by the Extraction of the Square Root; for ſhould it be ſuppoſed that a Rope of 10 inches compaſs, is but double the ſtrength of a Rope of 5 inches, upon proof it is manifeſtly falſe, for the ſaid Rope of 10 inches is four times of the ſtrength of that of 5.

The Rule.

Take the Compaſs of the given Rope (*viz.* 5) and multiply that by it ſelf; which Product (becauſe the other Rope is to be twice as ſtrong) multiply by 2, and the Square Root of the Product is the Compaſs of the Rope required.

Example.

The given Rope's Compaſs 5 inches.
Multiplied by it ſelf —— 5
The Square ——————— 25
Multiplied by ——————— 2
50

Extract the Root 50(7 0.
49
1.

So

So that by the Operation it appears, a Rope to be twice the ſtrength of the given Rope of 5 inches compaſs, muſt be 7 inches, 0.

If it be deſired to know the weight of one Rope by another, it is as follows.

The Proportion is,

As the Square of the Compaſs of the one Rope, is to the Square of the Compaſs of the other; ſo is the weight of the one to the weight of the other, length for length.

Example.

Suppoſe a Cable of 10 inches to weigh 21 hundred, and the weight of a Cable of 8 inches required. Say;

As 100 (the Square of 10) to 64 (the Square of 8) ſo is 21 C. the weight of one Cable to 13 C. $\frac{44}{100}$ parts the weight of the other Cable required.

The Extraction of the Cube Root.

I Shall firſt as neceſſary inſert a Table of the Cubes of the Nine Digits, which ought firſt to be committed to Memory.

Cubes of the Nine Digits.

1	001	6	216
2	008	7	343
3	027	8	512
4	064	9	729
5	125		

Example 1.

Extract the Cube Root of 12167.

Firſt point the given number, (*i. e.*) put a prick over every third figure, then ſeek the greateſt Cube in the firſt Point (*viz.* 12) which is 8 the Cube Root, whereof (which is 2) place in the Quotient; Subtract the Cube (8) from the firſt Point (12), place the Remainder underneath; to this Remainder bring down the next point (167), and call this the

Reſolvend; then draw a line underneath it, then ſquare the Quotient (2) which is 4, multiply the ſaid ſquare (4) by 300, which makes 1200, place this under the Reſolvend, and call it the Treble Square; again, multiply the Quotient (2) by 30: which makes 60, place this under the Treble Square, and call it the Treble Quotient; add theſe two (*viz.* Treble Square and Treble Quotient) into one Sum, and call it the Diviſor; ſeek how often this Diviſor is contained in the Reſolvend, which is 3 times, which 3 place in the Quotient; multiply the Treble Square by the 3 laſt placed in the Quotient, and ſubſcribe the Product underneath the Diviſor; ſquare the ſaid figure (3) laſt placed in the Quotient, and thereby multiply the Treble Quotient, and place it underneath the laſt Product, Cube the figure (3) laſt placed in the Quotient, and place it underneath the preceding Products: Laſtly, Add theſe three Products into one ſum, and ſubtracting the ſaid ſum from the Reſolvend, ſubſcribe the Remainder; to which Remainder, had there been any more figures, the next point muſt have been brought down, and the preceding Work reiterated from the ſquaring of the Quotient, until all the figures are ſo brought down; but in this Example, there being no more figures, the Work is done, and by the Operation the Cube Root of 12167, appears to be 23 juſt, nothing remaining.

```
12167 (23 Root.
 8
-----
 4167 Reſolvend.
 1200 Treble Square.
   60 Treble Quot.
-----
 1260 Diviſor.
-----
 3600
  540
   27
-----
 4167
-----
 0000
-----
```

Example 2. applied.

Suppoſe a Ship of 300 Tun, 75 foot by the Keel, 29 foot and a half at the Beam, and 13 foot deep in the Hould; and another Ship is deſired of the ſame Mould and Shape of 500 Tun: the ſeveral dimenſions of the ſaid Ship are found by the Extraction of the Cube Root.

Example.

Example.

Beginning with the Keel: Firſt, Cube the length of the given Keel, which is done by multiplying it into it ſelf, and then multiplying the Product by it again.

Then ſay by the Rule of Three, As 300 Tun the one Ships Burthen, to 500 Tun the other Ships Burthen; ſo is 421875 the Cube of the one Ships Keels length, to the Cube of the other's Keels length. Which being wrought by the Rule of Three, gives 703125: from which extract the Cube Root, and that will be the length of the Keel required.

In this Extraction is added 3 Ciphers to bring out the Fraction, the Operation therewith being the ſame as if there had been more figures in the propoſed Number; the Operation gives for the length of the Keel required 88 foot $\frac{2}{10}$ parts.

Thus having found one of the Dimenſions, the reſt may be found without the Extraction of the Root by the Rule of Three:

Thus;

Suppoſe the next thing I would find, to be her breadth by the Beam, ſay; As the length of the one Ships Keel 75, is to the length of the other 89 *fere*. So is 29 $\frac{1}{2}$ foot, the breadth of the one Ship by the Beam, to the breadth of the other, which by the Rule of Three gives 35 foot $\frac{3}{5}$.

75 given Keel
75
375
525
5625
75
28125
39375
421875 Cube given Keel.

703125 (88 $\frac{2}{10}$ Root.
512
191125 Reſolvend.
19200 Treble Square.
240 Treble Quotient
19440 Diviſor.
153600
15360
512
169472
21653,000 Reſolvend.
2323 200 T. S.
2640 T. Q.
2325 840 Diviſor.
20908 800
213 840
729
21123 369
529 631 Remaind.

Example

Example 3.

Suppose an Iron Shot 4 inches Diameter to weigh 9 lb, and the Diameter of a Shot whose weight is 72 lb required. This also is done by the Extraction of the Cube Root, as follows: First, say by the Rule of Three.

As 9 lb, the weight of one shot, to 72 lb, the weight of the other: so is 64 the Cube of the one Shots Diameter, to the Cube of the other Shots Diameter, which by the Operation is 512, the Cube Root of which is 8, the Diameter of the Shot required.

But if it were required, to find the Weight of a Shot by the Diameter, it's done thus, by the Rule of Three.

As the Cube of the one Shots Diameter to the Cube of the other;

So is the Weight of the one Shot to the Weight of the other required. And thus much for the Arithmetical part of this Treatise.

Some neceſſary Geometrical Problems.

PROBLEM I.

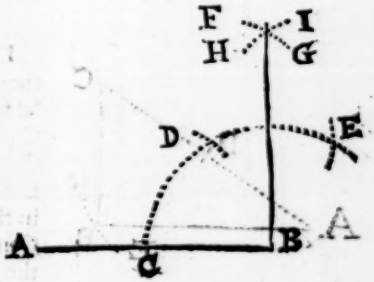
To raiſe a Perpedicular on the middle of a Line.

LEt the Line given be A B, and the Perpendicular to be raiſed from the point C; to do which, ſet off the two equal diſtances, C A and C B: then the Compaſſes being opened to any convenient diſtance bigger than A C or C B, with one foot of the Compaſſes in the point A, deſcribe the Arch D E; then with one foot in the point B deſcribe the Arch F G, then draw the Perpendicular from the point C through the Interſection (or cutting) of the two Arches F G and D E, which was required.

PRO-

PROBLEM II.

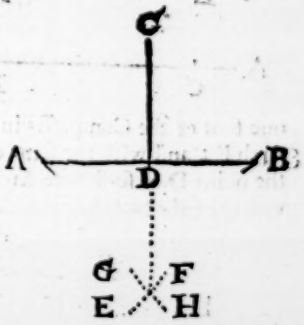
To raiſe a Perpendicular on the end of a Line.



Let the Line given be AB, and the Perpendicular to be raiſed from the point B; to do which, with one foot of the Compaſſes at B, with any convenient diſtance, as BC, ſweep an Arch; then with the ſame extent, one foot of the Compaſſes being in the point C, mark the ſaid Arch at the point D, and one foot being at D mark it at E, then with the ſame diſtance, one foot of the Compaſſes being in the point D, deſcribe the Arch F G, and placing the Compaſſes in the point E, deſcribe the Arch H I; then from the point B, and through the Interſection of the two Arches, F G and H I, draw the Perpendicular which was required.

PROBLEM III.

To let fall a Perpendicular on the middle of a Line, from a certain point aſſigned over the ſaid Line.

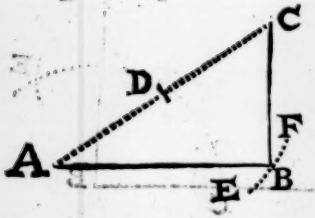


Let A B be the Line given, C the Point over the Line, from which the Perpendicular is to fall; to do which, place one foot of the Compaſſes in the Point C, then opening them to a convenient diſtance, mark the Line A B in two points with the ſaid diſtance, as in the points A and B; then with one foot of the Compaſſes the point A, deſcribe the Arch E F, and with one foot in the point B, deſcribe the Arch G H; then from the point C, and by the Interſection of the ſaid two Arches, draw the Perpendicular which was required.

PRO-

PROB. IV.

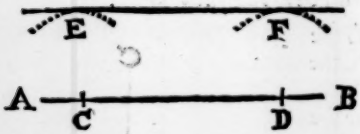
To let fall a Perpendicular on the end of a Line, from a Point assigned.



Let the Line given be A B, upon the end of which let it be required to let fall a Perpendicular from the point C; to do which, from the point assigned C, draw the Line C A; which Line divide into two equal parts, as in the point D, then one point of the Compasses resting in the point D, with the same distance (*viz.* of half the Line A C) describe the Arch E F; then from the point C, to the Intersection of the Arch E F with the Line A B, draw the Perpendicular as was required.

PROB. V.

To draw a Line parallel to a Line given.



Let A B be a Line given, to which it is required to draw a Line parallel; to do which, first Take in the Compasses the distance at which the parallel Line is to be drawn, and then setting one foot of the Compasses in the point C, on the Line A B describe the Arch E; and with the same distance, with one foot of the Compasses in the point D, describe the Arch F; then laying a Ruler to touch the Convexity of the two Arches, draw the Parallel as was required.

PROB.

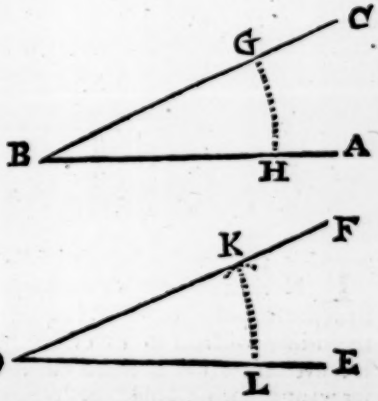
PROB. VI.

To draw a Line Parallel to a given Line, that ſhall paſs through a point aſſigned over the ſaid given Line.

Suppoſe A B the given Line, and it is required to draw a Line Parallel thereto that ſhall paſs through the point C: Firſt, Take the neareſt diſtance between the ſaid point and the given Line, and with the ſaid diſtance, ſetting one foot of the Compaſſes in the Point D, deſcribe the Arch E F; then by the Convexity of the ſaid Arch, and the given point C, draw the Parallel as was required.

PROB. VII.

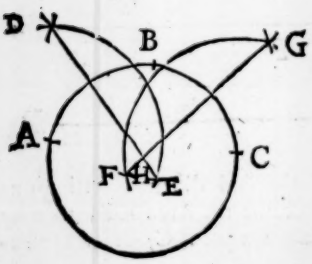
To make an Angle equal to any given Angle.



Suppoſe A B C an Angle given, and it is required to make another Angle equal thereto: To do this, firſt, Draw the Line D E, then with any convenient diſtance leſs than A B, deſcribe the Arch G H; then placing the Compaſſes at D, with the ſame diſtance which ſwept the Arch G H ſweep the Arch K L; then take the length of the Arch G H in the Compaſſes, and ſetting one foot in the point L, croſs the Arch L K in the point K, then through the point K draw the Line D F; then is the Angle E D F, equal to the Angle A B C, as was required.

PROB. VIII.

To bring any three Points not ſcituate in a right Line, into the circumference of a Circle.



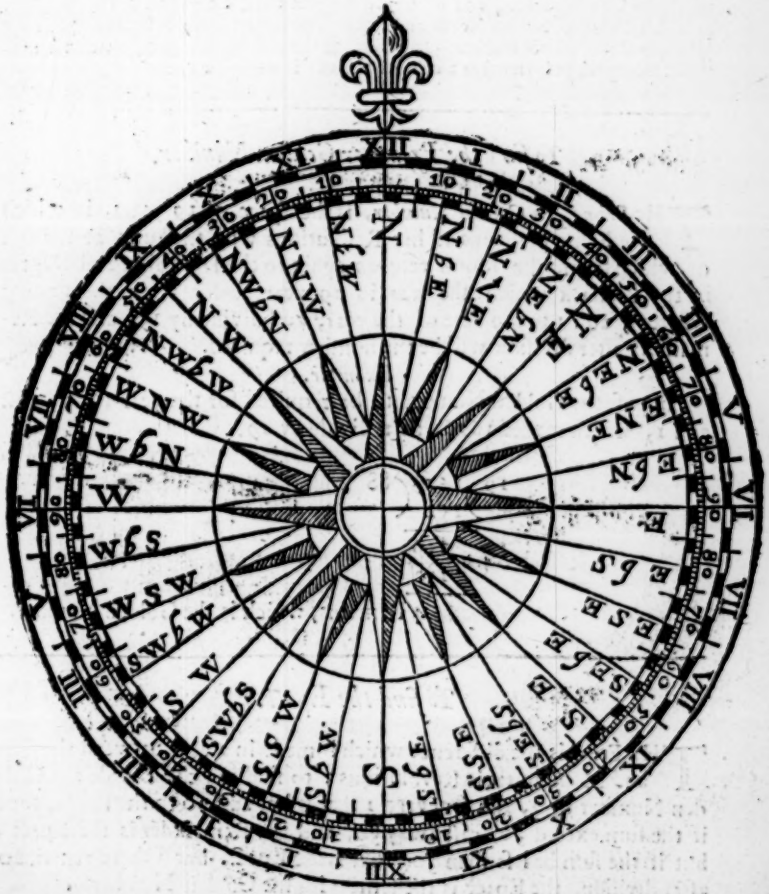
Let the three Points through, which the Circle is to paſs be A B C: Take above half the diſtance between the two Points A and C in the Compaſſes, and one foot of the Compaſſes being in the point A, with the ſaid diſtance deſcribe the Arch E D, and with the ſame diſtance, one foot of the Compaſſes being in the point C, mark the Arch E D in the points E D, and draw the right Line E D; then take above half the diſtance between the Points C and B in the Compaſſes; and one foot of the Compaſſes being in the Point B, with the ſaid diſtance deſcribe the Arch F G; and with the ſame diſtance, one foot of the Compaſſes being in the point C, mark the Arch F G in the Points F and G, and draw the right Line F G; now where the two right Lines D E and F G being continued, interſect each other, (*viz.* in the point H) is the Center of the Circle which was required.

Of the Mariners Compaſs.

THis Inſtrument ſo beneficially aſſiſtant to the practical part of Navigation, as to it's Author, is uncertainly diſcourſed of; it's age by ſome ſuppoſed to be in theſe parts of the World about 300 years; the utility whereof to us evidently appears. Conſidering the many inconveniences that attended our Anceſtors, in tracing the vaſt Ocean for want of ſuch a guide, under whoſe ſubordinate Conduct, of later years, our Maritime Affairs have ſucceeded ſo well.

The Description of the Compass.

It is a Circle of a greater or lesser Diameter at pleasure, described upon a Paste-Board, and divided into 360 Degrees and 32 Points, and some times into 24 Hours, each Point containing 11 deg. 15 min. or ½ of an hour, as in the following Figure.



To divide which into Points, first draw a Line at pleasure, as VV. E. then cross it with another at right angles, as N. S. then setting one foot of the Compasses in the intersection (or cutting) of those two Lines, the Compasses being opened to the intended bigness, sweep the Circle, and divide each of the 4 equal parts made by the Circle, and the two right Lines VV. E. and N. S. into eight equal parts more. So is the Compass divided into 32 Points, as in the foregoing Figure.

The Circle being thus divided upou the Chard, or Paste-Board, there are pasted on the other side of the said Chard, or Paste-Boad, two VVires, which VVires being touched with a Loadstone, and the Chard hung at the Center upon a Pin fixed in a Box, it's Position becomes North and South; and the said Box being covered with a Glass, and hung into another square Box, to the end the Chard may traverse notwithstanding the Ships motion; being thus fixed, is ready for use.

To find the Prime or Golden Number.

THe *Prime*, or *Golden Number*, is the space of 19 years, in which the Moon performs all her Resolutions with the Sun; at the end of which term, the Moon returns again to the same Sign and Degree in the Zodiack which she was in 19 years before; for the finding whereof, add 1 to the date of the year, and divide by 19, and the Remainder after division will be the number required.

Example.

Suppose the Golden Number to be required for the year 1675; first add 1, which makes 1676, then divide by 19.

19)1676(88
152
156
152
4 Remains, which is the Golden Number.

To find the Epact.

THe *Epact* is the difference which is made in a year between the Sun and Moon in their Revolutions; to find which, Divide the Golden Number by 3, and for every 1 that is left add 10 to the Prime, then if the sum exceed 30, cast away 30, and the Remainder is the Epact; but if the sum be less than 30, that is the Epact, but if there remains o after division, the Epact is the same with the Golden Number.

Example.

Example.

Suppoſe the Epact were required for the year 1075; the Golden Number being found to be 4, being divided by 3, there remains 1, which being made 10, and added to the Prime 4, makes 14, which is the Epact for 1675 required.

To find the Moons Age.

ADd to the Epact, for *March* 1, for *April* 2, for *May* 3, for *June* 4, for *July* 5, for *Auguſt* 6, for *September* 8, for *October* 8, for *November* 10, for *December* 10, for *January* 0, for *February* 2.

Having added to the Epact the number for the Month, according to the Rule foregoing, add thereto the day of the Month, for which the Moons Age is required; theſe 3 ſums added together, if leſs than 30 is the Moons Age; if more than 30, take 30 from it as often as may be, the Remainder is the Age of the Moon. The Moons Age ſubtracted from 30, leaves the day of Change. Again, 15 added to, or ſubtracted from the day of Change, leaves the day of Full Moon.

Example.

Suppoſe it were required to find the Moons Age for the fifth day of *September* 1675.

First ſet down the Epact for that year ——— 14
To which add the Number for the Month, which is — 08
To which add the day of the Month, which is ——— 5

The Moon is 27 days old.

Then out of 30
Take ——— 27 the Moons Age.

Remains ——— 3 Days to the Change.
Add ——— 15

Makes ——— 18 Days to Full Moon.

If the Practitioner pleaſe to ſave himſelf the labour of theſe Operations, he may in the following Page, ſee the Table where it is ſet down.

To find the Dominical Letter.

TAke the year and its fourth part, and add 4 to it; then divide the Sum by 7, and ſubtract what remains from 7, the Remainder ſhews the thing required, accounting the Letter A for 1, B for 2, C for 3, D for 4, E for 5, F for 6, and G for 7. 0.

Sup-

Suppose the Dominical Letter were required for the year 1675.
First, Set down the year ——— 1675
Then the 4th part, which omitting Fraction, is ——— 418
To which add ——— 4

The Sum divide by ——— 7) 2097 (299
14 ..
69
63
67
63
4

The Remainder after Division is 4, which being subtracted from 7, leaves 3; which shews it must be the third Letter, which is C, the Dominical Letter for 1675 required.

To find the Cycle of the Sun.

ADd to the year 9, divide the sum by 28, the Remainder is the Cycle of the Sun.

Suppose it to be required for the year 1675
Then add ——— 9

Divide by ——— 28) 1684 (60
168.
04

By the Operation it appears that 4 is the Cycle of the Sun for the year 1675, being the Remainder after division.

To save this labour, I shall add the Table following.

Note, *Hillary* Term begins *Jan.* 23. and ends *Feb.* 12.
Easter Term begins 17 days after *Easter* day, and ends the Munday before *Whitsunday.*
Trinity Term begins on Friday after *Trinity* Sunday, and ends 19 days after.
Michaelmas Term begins *Octob.* 23. and ends *November* 28.

A Table

A Table of the Dominical Letters, Cycle of the Sun, Prime, Epact, and Moveable Feasts for 25 Years.

Years.	Dom. Let.	Cycl. ☉.	Prime.	Epact.	Shrove-Sunday.	Easter-Sunday.	Whit-Sunday.
1676	B A	5	5	25	February 6	March 26	May 4
1677	G	6	6	6	25	April 15	June 3
1678	F	7	7	17	10	March 31	May 19
1679	E	8	8	28	March 2	April 20	June 8
1680	D C	9	9	9	February 22	11	May 30
1681	B	10	10	20	13	3	22
1682	A	11	11	1	26	16	June 4
1683	G	12	12	12	18	8	May 27
1684	F E	13	13	23	10	March 30	18
1685	D	14	14	4	March 1	April ✓ 19	June 7
1686	C	15	15	15	February 14	4	May 23
1687	B	16	16	26	6	March 27	15
1688	A G	17	17	7	26	April 15	June 13
1689	F	18	18	18	10	March 31	May 19
1690	E	19	19	29	March 2	April 20	June 8
1691	D	20	1	11	February 23	12	May 31
1692	C B	21	2	22	7	March 27	15
1693	A	22	3	3	26	April 16	June 4
1694	G	23	4	14	18	8	May 27
1695	F	24	5	25	March 3	✗ 25	12
1696	E D	25	6	6	February 23	12	31
1697	C	26	7	17	14	April 4	May 23
1698	B	27	8	28	March 6	24	June 12
1699	A	28	9	9	February 19	9	May 28
1700	G F	1	10	20	February 11	March 31	May 19

A Table of the Moons Age for the Year 1676.

M.		D.	H.	M.
January.	New moon.	04	16	55
	First quart.	12	08	52
	Full moon.	20	07	20
	Last quart.	27	05	54
February.	New moon.	03	06	59
	First quart.	11	06	15
	Full moon.	18	20	27
	Last quart.	25	13	44
March.	New moon.	03	22	10
	First quart.	12	01	52
	Full moon.	19	06	46
	Last quart.	25	22	02
April.	New moon.	02	13	59
	First quart.	10	17	56
	Full moon.	17	15	06
	Last quart.	24	07	35
May.	New moon.	02	05	57
	First quart.	10	06	03
	Full moon.	16	22	23
	Last quart.	23	18	44
	New Moon	31	21	27
June.	First quart.	08	14	46
	Full moon.	15	05	39
	Last quart.	22	08	09
	New moon.	30	11	51

M		D.	H.	M
July.	First quart.	07	21	18
	Full Moon.	14	13	40
	Last quart.	21	23	58
	New moon.	30	00	54
August.	First quart.	06	02	46
	Full moon.	12	23	20
	Last quart.	20	18	01
	New moon.	28	12	32
September.	First quart.	04	08	36
	Full moon.	11	11	36
	Last quart.	19	13	05
	New moon.	26	23	17
October.	First quart.	03	15	50
	Full moon.	11	02	45
	Last quart.	19	07	36
	New moon.	26	09	34
November.	First quart.	02	01	23
	Full moon.	09	20	49
	Last quart.	18	00	18
	New moon.	24	19	58
December.	First quart.	01	14	14
	Full moon.	09	16	27
	Last quart.	17	14	08
	New moon.	24	06	34
	First quarter	31	06	30

Two Eclipses this Year, and both of the Sun.

The first, on *June* 1. about 10 in the Morning, visible to us, as also at the *Canary-Islands*, *Greenland*, *Hispaniola*, *Cuba*, &c.

The second, on *Novemb.* 25. about 8 in the Morning; visible in *New Guinea*, *Madagascar*, *Virginia*, *the Ethiopian-Sea*.

M.		D.	H.	M.
January.	Full moon.	08	11	41
	Last quart.	16	01	23
	New moon.	22	17	35
	First quart.	30	01	41
Febr.	Full moon.	07	04	50
	Last quart.	14	10	20
	New moon.	21	05	25
	First qart.	28	22	19
March.	Full moon.	08	19	05
	Last quart.	15	17	25
	New moon.	22	17	57
	First quart.	30	18	04
April.	Full moon.	07	06	29
	Last quart.	13	23	43
	New moon.	21	07	47
	First quart.	29	11	18
May.	Full moon.	06	15	34
	Last quart.	13	06	29
	New moon.	20	22	27
	First quart.	29	01	35
June.	Full moon.	04	23	04
	Last quart.	11	14	42
	New moon.	19	13	38
	First quart.	27	14	00

M.		D.	H.	M.
July.	Full moon.	04	05	50
	Last quart.	11	01	29
	New moon.	19	04	51
	First quart.	26	21	58
August.	Full moon.	02	12	57
	Last quart.	09	15	02
	New moon.	17	19	18
	First quart.	25	05	27
	Full moon.	31	21	28
September.	Last quart.	08	09	04
	New moon.	16	09	12
	First quart.	23	21	08
	Full moon.	30	08	39
October.	Last quart.	08	04	44
	New moon.	15	22	49
	First quart.	22	19	00
	Full moon.	29	22	56
November.	Last quart.	07	01	11
	New moon.	14	11	16
	First quart.	21	03	24
	Full moon.	28	16	14
December.	Last quart.	06	20	40
	New moon.	13	22	44
	First quart.	20	14	09
	Full moon.	28	11	15

Four Eclipses this Year, two of the Sun, and two of the Moon.

1. Of the Moon, on *May* 7. at 3 in the Morning, partly to be seen of us, as also in *Madagascar*, in *Polonia*, &c. 2. Of the Sun, *May* 21. about 10 in the Morning, scarcely visible to us, but towards the Islands of S. *Martin*, S. *Hellen*, S. *Mary*. 3. Of the Moon *October* the 30. about 11 Fore-noon, Invisible to us, but to be seen of our Antipodes. 4. Of the Sun, *Novemb.* 14. about Midnight, not to be seen of us, but in *China*, *Japan*, &c.

A Table of the Moons Age for the Year 1678.

M.	☽	D.	H.	M.
January.	Last quart.	05	13	41
	New moon.	12	09	08
	First quart.	19	04	00
	Full moon.	27	06	14
February.	Last quart.	04	03	27
	New moon.	10	19	01
	First quart.	17	20	05
	Full moon.	26	00	13
March.	Last quart.	05	13	30
	New moon.	12	04	53
	First quart.	19	14	05
	Full moon.	27	15	47
April.	Last quart.	03	19	41
	New moon.	10	15	28
	First quart.	18	08	25
	Full moon.	26	04	38
May.	Last quart.	03	02	03
	New moon.	10	02	59
	First quart.	18	02	07
	Full moon.	25	14	51
June.	Last quart.	01	07	11
	New moon.	08	15	44
	Firstquart.	16	18	20
	Full moon.	23	23	06
	Last quart.	30	13	28
July.	New moon.	08	05	37
	First quart.	16	08	38
	Full moon.	23	06	07
	Last quart.	29	22	05
August.	New moon.	06	20	38
	First quart.	14	20	49
	Full moon	21	13	16
	Last quart.	28	10	02
September.	New moon.	05	12	44
	First quart.	13	06	53
	Full moon.	19	21	38
	Last quart.	27	01	23
October.	New moon.	05	05	09
	First quart.	12	15	23
	Full moon.	19	08	09
	Last quart.	26	20	07
November.	New moon.	03	21	19
	First quart.	10	23	12
	Full moon.	17	21	10
	Last quart.	25	17	35
December.	New moon.	03	11	52
	First quart.	10	07	14
	Full moon.	17	12	42
	Last quart.	25	14	33

Five Eclipses this Year, three of the Sun, and two of the Moon.

1. Of the Sun, *April* 11, at 3 in the Morn. Invisible to us, but to be seen in *Tartaria*, &c. 2. Of the Moon, *April* 26. at 5 Afternoon, to us invisible, seen in *Persia*, *Arabia Felix*, and the *Caspian Sea*, &c. 3. Of the Sun, *October* 5. about 5 Afternoon, invisible to us. 4. Of the Moon, *Octob.* 19. at 8 at Night, visible to most parts of *Europe* 5. Of the Sun, *Novemb.* 4. about 9 in the Morn. Visible in the Northern Seas.

A Table of the Moons Age for the Year 1679.

M.		D.	H.	M.
January.	New moon.	02	00	17
	First quart.	08	15	20
	Full moon.	16	06	01
	Last quart.	24	09	58
	New moon.	31	13	19
Febr.	First qart.	07	02	26
	Full moon.	15	00	28
	Last quart.	23	02	26
March.	New moon.	01	20	48
	First quart.	08	15	47
	Full moon.	16	16	58
	Last quart.	24	15	15
	New moon.	31	06	32
April.	First quart.	07	06	56
	Full moon.	14	23	45
	Last quart.	22	23	57
	New moon.	29	07	26
May.	First quart.	06	23	04
	Full moon.	15	00	23
	Last quart.	22	12	33
	New moon.	28	23	25
June.	First quart.	05	15	58
	Full moon.	13	15	54
	Last quart.	20	09	08
	New moon.	27	09	59
July.	First quart.	05	08	51
	Full moon.	12	22	43
	Last quart.	19	13	12
	New moon.	26	22	31
August.	First quart.	04	01	06
	Full moon.	11	06	15
	Last quart.	17	20	03
	New moon.	25	13	14
September.	First quart.	02	16	52
	Full moon.	09	14	35
	Last quart.	16	06	17
	New moon.	24	05	55
October.	First quart.	02	06	39
	Full moon.	08	23	16
	Last quart.	15	20	39
	New moon.	24	03	32
	First quart.	31	18	38
November.	Full moon.	07	09	10
	Last quart.	14	14	20
	New moon.	22	15	43
	First quart.	30	04	13
December.	Full moon.	06	21	09
	Last quart.	14	10	35
	New moon.	22	10	26
	First quart.	29	11	20

Four Eclipses this Year: Two of the Sun, and Two of the Moon.

1. Of the Sun. *March* 31 at 7 at Night, not to be seen of us, but in the *Atlantick-Sea*, *New-France*, &c. 2. Of the Moon. *April* 15. at 10 in the Evening, scarcely to be seen of us, but Visible in *Russia*, *Polonia*, *Dalmatia*, *Hungary*, 3. Of the Sun, *Septemb.* 24 at 6 at Night, not Visible to us, but in *New Zealand*, the *Pacifick-Sea*, &c. 4. Of the Moon, *Octob.* 9. at 11 Forenoon, not to be seen of us, but of our *Antipodes*.

A Table of the Moons Age for the Year 1680.

M.		D.	H.	M.
January.	Full moon.	05	10	06
	Last quart.	13	07	03
	New moon.	21	00	59
	First quart.	27	19	19
February.	Full moon.	04	02	01
	Last quart.	12	03	58
	New moon.	19	22	57
	First quart.	26	03	36
March.	Full moon.	04	18	39
	Last quart.	12	21	55
	New moon.	19	22	20
	First quart.	26	11	26
April.	Full moon.	03	11	25
	Last quart.	11	12	54
	New moon.	18	06	17
	First quart.	25	01	52
May.	Full moon.	03	03	09
	Last quart.	11	02	56
	New moon.	17	13	50
	First quart.	24	14	59
June.	Full moon.	01	18	13
	Last quart.	09	07	20
	New moon.	15	21	31
	First quart.	23	06	17

M.		D.	H.	M.
July.	Full moon.	01	07	22
	Last quart.	08	12	15
	New moon.	15	16	39
	First quart.	22	23	12
	Full moon.	30	19	17
August.	Last quart.	06	15	02
	New moon.	13	07	32
	First quart.	21	16	47
	Full moon.	29	05	43
September.	Last quart.	04	21	28
	New moon.	12	06	57
	First quart.	20	10	31
	Full moon.	27	08	08
October.	Last quart.	04	05	23
	New moon.	13	02	58
	First quart.	20	01	30
	Full moon.	27	01	19
November.	Last quart.	02	16	19
	New moon.	10	18	13
	First quart.	18	18	50
	Full moon.	25	11	20
December.	Last quart.	02	09	34
	New moon.	10	13	33
	First quart.	18	07	34
	Full moon.	24	20	22

Two Eclipses this Year, and both of the Sun.

The first, *March* 20. at 10 in the Morning, in part to be seen of us, but more conspicuous in the South parts of *America*, Cape St. *Vincent*, &c.

The second, *Sept.* 12. at 8 at Night, not to be seen in these parts.

A Table of the Moons Age for the Year 1681.

M.		D.	H.	M.
January.	Last quart.	01	04	18
	New moon.	09	07	52
	First quart.	16	17	25
	Full moon.	23	10	06
	Last quart.	31	00	27
Febr.	New moon.	07	23	48
	First quart.	15	00	37
	Full moon.	21	23	06
Marcb.	Last quart.	01	20	45
	New moon.	09	12	43
	First quart.	16	06	45
	Full moon.	23	13	24
	Last quart.	31	15	15
April.	New moon.	07	23	03
	First quart.	14	13	24
	Full moon.	22	04	29
	Last quart.	30	07	34
May.	New moon.	07	07	11
	First quart.	13	21	47
	Full moon.	21	19	58
	Last quart.	29	20	41
June.	New moon.	05	13	07
	First quart.	12	08	53
	Full moon.	20	10	45
	Last quart.	28	08	24

M.		D.	H.	M.
July.	New moon.	04	21	41
	First quart.	11	22	40
	Full moon.	20	01	18
	Last quart.	27	14	25
August.	New moon.	03	04	57
	First quart.	10	14	03
	Full moon	18	14	20
	Last quart.	25	20	07
September.	New moon.	01	14	43
	First quart.	09	08	09
	Full moon.	17	04	05
	Last quart.	24	01	03
October.	New moon.	01	03	09
	First quart.	09	03	20
	Full moon.	16	16	04
	Last quart.	23	08	01
November.	New moon.	01	03	09
	First quart.	07	22	38
	Full moon.	15	05	08
	Last quart.	21	17	50
	New moon.	29	12	56
December	First quart.	07	16	36
	Full moon.	14	13	52
	Last quart.	21	08	08
	New moon.	29	08	26

Four Eclipses this Year, two of the Sun, and two of the Moon.

1. Of the Moon, *Feb.* 22. about 11 Forenoon, not seen of us, but Visible to our *Antipodes*. 2. Of the Sun, *March* 10, at 1 in the Morning, Visible to our *Antipodes*. 3. Of the Moon, *August* 19. about 3 in the Morn. A total Eclipse, Visible to us. 4. Of the Sun, *Septemb.* 12. at 3. in the Morn. not Visible to us, but a small Eclipse where most conspicuous.

A Table of the Moons Age for the Year 1682.

M.		D.	H.	M.
January.	First quart.	06	08	21
	Full moon.	13	00	12
	Last quart.	19	23	20
	New moon.	28	03	32
February.	First quart.	04	20	58
	Full moon.	11	11	25
	Last quart.	18	17	37
	New moon.	26	20	48
March.	First quart.	06	05	11
	Full moon.	12	21	45
	Last quart.	20	12	33
	New moon.	28	10	56
April.	First quart.	4	10	51
	Full moon.	11	09	34
	Last quart.	19	06	45
	New moon.	26	22	09
May.	First quart.	03	15	29
	Full moon.	10	22	17
	Last quart.	18	23	49
	New moor.	26	07	02
June.	First quart.	01	20	49
	Full moon.	09	11	57
	Last quart.	17	14	50
	New moon.	24	14	52

M.		D.	H.	M.
July.	First quart.	01	05	04
	Full moon.	09	22	32
	Last quart.	17	03	57
	New moon.	23	21	31
	First quart.	30	14	13
August.	Full moon.	07	17	06
	Last quart.	15	14	30
	New moon.	22	04	44
	First quart.	26	06	31
September.	Full moon.	06	09	34
	Last quart.	13	23	00
	New moon.	20	13	59
	First quart.	28	00	02
October.	Full moon.	06	01	04
	Last quart.	13	05	58
	New moon.	20	01	18
	First quart.	27	19	39
November.	Full moon,	04	15	30
	Last quart.	11	14	05
	New moon.	18	15	22
	First quart.	26	16	17
December.	Full moon.	04	05	07
	Last quart.	10	20	37
	New moon.	18	08	32
	First quart.	26	12	20

Five Eclipses this Year: Three of the Sun and two of the Moon.

1. Of the Sun. *Jan.* 28. at 5 in the Afternoon; Invisible to us. 2. Of the Moon, *Feb.* 11. half past 11 at Night; Visible in the *North-Sea*, *Europe*, *Africa*, and some parts of the *East-Indies*. 3. Of the Sun, *July* 24. at 9 in the morn. not Visible to us. 4. Of the Moon, *Aug.* 8. at 6 in the Morn. Visible in *England*, the *North-Sea*, *America*, and the *South-Sea*. 5. Of the Sun, *Aug.* 22. at half past 5 in the Afternoon, not to be seen of us.

The Explanation and Uſe of the preceding Table of the Moons Age.

IN the ſaid Table, the one half Page contains the firſt ſix months of the year, the other half the following ſix months: in the firſt Column of each half, towards the left hand, are the Months; in the ſecond, the New, Full, and Quarters of the Moon; in the three following Columns are the Days, Hours and Minutes of the ſaid New, Full, and Quarters; which time is accounted from Noon to Noon: at the bottom of the Tables are the Eclipſes for the Reſpective years.

Uſe of the Table.

The uſe of this Table is readily by inſpection to find the Day, Hour, and Minute of the New, Full, or Quarters of the Moon.

Example 1.

Suppoſe it were deſired to find the time of New Moon in *Jan.* 1676.

Firſt, Look for the Year 1676, on the top of the Leaf, which having found, look for *January* in the firſt Column towards the left hand; then in the next Column, in the ſame month, is found New Moon; and in the three following Columns, againſt New Moon, ſtands 4|16|55|, which ſhews that the New Moon in *January* 1676 is the 4 day, 16 hours, 55 minutes afternoon: The ſame Directions and Conſiderations ſerve for the Full Moon, or firſt and laſt Quarters.

Note, That when the Moon is in the firſt Quarter, it is 8 days old, at the Full 15 days, and in the Laſt Quarter 22 days. Suppoſe therefore it were required to find the Moons Age on *March* 20, 1678.

Looking in the year 1678, the Table gives the New Moon to be on the 12*th* day, therefore 12 and 8 being 20, it appears the Moon is 8 days old on the ſaid 20*th* of *March*.

Example 2.

Suppoſe it were required to find the Moons Age on the 30*th* of *June*, 1678.

Looking in the year 1678, in the Month of *June*, I find the Moon to be at the Full on the 24*th* day, that is, 15 days old; then the day for which I would find its Age, being 6 days after the 26*th* day, 15; and 6 making 21, I conclude the Moon to be 21 days old on the ſaid 30*th* day of *June*, 1678.

A Tide

A Tide-Table for the Sea Coasts of Great-Britain, Ireland, Norway, Holland, Flanders, France, Biscay, *&c. Shewing what Moon makes Full Sea upon the Full and Change Days at the Places following, in Alphabetical order.*

A.	H.	M.
At *Army* N.N.E. and S.S.W.	01	30
At *Amsterdam* and *Armentiers*, North-East and South-West.	03	00
At *Aberwark* E. N. E. and W. S. W.	04	30
At *Abermorick* and *Antwerp* East and West.	06	00
At *Alborough* South-East by South, and North-West by North.	09	45
B.		
At *Beachy*, and before the *Race* of *Blanquet* North and South	12	00
At *Blacktail* and thwart of *Beachy* in the *Offing*, North by East, and South by West	12	45
At *Blackness* in *Bluet*, at *Bel-Isle*, at *Baraick* N. N.E. and S.S.W.	01	30
Without *Bluet*, North-east by North, and South-west by South	02	15
The River of *Bourdeaux*, the South Coast of *Britaign*, the Coast of *Biscay*, and at *Boekness* North-east and South-west	03	00
At *Brest*, before the *Bass*, the River of *Bourdeaux* within the Haven, and at *Barwick* North-east by East and South-west by West	03	45
In the *Bree-sound*, *Bloy*, *Baltimore*, E. N. E. and W.S.W.	04	30
Before *Bremen*, and at *Blackney*, in the Channel before *Bourdeaux*, and at *Bristol*, East and West	06	00
At *Bristol* Key East by South add West by North-	06	45
At *Bridgwater*, E. S. E. and W.N. W.	07	30
Between *Beachy* and the *Isle of Wight*, South-east by East, and North-west by West	08	15
Bulleyn-deep, S.S.E. and N. N. W.	10	30

C.

C.

	H.	M.
In the *Condado*, North and South	12	00
In the *Camber* of *Rië*, North by East, and South by West	12	45
Without *Calice*, at *Corpus-Christi* Point, before *Camfere*, and at *Camfere*, N. N. E. and S. S. W.	01	30
Between *Calice* and *Dover*, before *Conquet*, and at the *North-Cape*, North-east and South-west	03	00
At *Cork*, at *Calice*, and in the *Creek*, E. N. E. and W. S. W.	04	30
At *Caldy*, and in the Bay of *Canarvan*, East by North and West by South	05	15
At *Concallo*, East & West	06	00
At Cape *Clear*, E. S. E. and W. N. W.	07	30
Without the *Caskets* in the Channel, S. E. by East, and N. W. by W.	08	15
Between *Garnsey* and the *Caskets*, before *Cromer*, before the *Caskets* and *Garnsey*, at *Seven-Clifts*, and at *Cateneſs*, S. E. and N. W.	09	00
At the *Caskets*, and at *Chamberneſs*, S. E. by South, and N. W. by North	09	45
At *Cows*, in the *Foſs* of *Caen*, in *Calice* Road, and in *Chamberneſs*-Road, S. S. E. and N. N. W.	10	30

	H.	M.
Before the Haven of *Caen*, in the *Chamber*, between *Cripple-Sand* and the *Creyl*, and at *Calſhot*, S. by East, and N. by West	11	15

D.

	H.	M.
At *Dover-Peer*, and before *Dunkirk*, North and South	12	00
At *Denby*, N. E. by N. and S. W. by S.	02	15
At *Dort*, N. E. and S. W.	03	00
At *Dungarvan*, E. N. E. and W. S. W.	04	30
At *Dartmouth*, East and West	06	00
At *Dublin*, S. E. by East, and N. W. by W.	08	15
At *Dunbar*, S. E. and N. W.	09	00
At *Dungeneſs* and *Dunnoſe*, S. E. by S. and N. W. by N.	09	5
At *Dover*, and in the *Downs*, S. S. E. and N. N. W.	10	30

E.

	H.	M.
At *Embden*, before the *Elve*, before the *Eyder*, and before *Enchuyſen*, North and South	12	00
At *Edam*, N. N. E and S. S. W.	00	03
Before the Eaſtern and Weſtern *Emes*, and at *Egmont*, S. E. and N. W.	09	00

F.

	H.	M.
On the Coast of *Flanders* North and South	12	00
At *Flushing* North by East, and South by West	17	45
Before the *Fen* in the Channel, N. N. E. and S. S. W.	01	30
Without *Fountnay* N. E. by North, and S. W. by South,	02	15
Without the Banks of *Flanders*, N.E. and S.W.	03	00
At *Flambrough* and *Bridlington*, E.N.E. and W.S.W.	04	30
At the *Fourn*, in *Foy*, at *Falmouth*, East by North, West by South	05	15
Between *Foy* and *Falmouth*, in the Channel, and at *Foulness*, East by South, and West by North	06	45
Before the Coast of *Friezland*, and the *Fly* E. S. E. and W. N. W.	07	30
Without the *Fly*, S.E. by East, and N.W. by West	08	15
At *Friez* and *Fair Isles*, N. W. and S. E.	09	00
In the *Frieth* and at the *South Foreland*, S.S.E. and N. N. W.	10	30
In *Fair-Isle* Roads, and at the *North-Foreland*, South by East, and North by West	11	15

G.

	H.	M.
In the Road of *Gibralten*, at *Graveling*, and before *Gherbrough*, North & South	12	00
Before *Core*, and at *Gravesend*, N.N.E. and S.S.W.	01	30
At *Groy*, at *Gascoign*, and the Coast of *Gallicia*, N.E. and S. W.	03	00
At *Garnsey*, East by North and West by South	05	15
Between *Garnsey* and *Caskets*, S. E. and N. W.	09	00
Thwart of *Garnsey* in the Channel, S.E. by South and N. W. by North	09	45
In the *Chamber* and *Goreend*, South by East and North by West	11	15

H.

	H.	M.
Before the *Hever*, before *Horn*, and at *Hampton Key*, North and South	12	00
Under *Holy-Island*, and at *Horn*, N. N. E. and S. S. W.	01	30
Before *Hartlepool*, N. E. and S. W.	03	00
At *Huntcliff foot*, N.E. by East, and S.W. by West	03	45
At *Humber*, East by North and West by South	05	15
Before *Hambrough*, at *Hull*, at the *Holms*, and before *Humbers* Mouth, East and West	06	00
At *Harlem*, and at *Homehead*, South-east and North-west	09	00

At

	H.	M.
At St. *Hellens*, at *Harwich*, and without the Banks of *Harwich* S.S.E. & N.N.W.	10	30
At *Harwich* within, S. by E. and North by West	11	15
I.		
At *Jutland*-Islands North and South	12	00
On the West Coast of *Ireland*, N.E and S. W.	03	00
In all the Havens on the South Coast of *Ireland*, East by North, and West by South	05	15
K.		
Kentish Knock, North and South	12	00
Killiars N.E. and S.W.	03	00
At *King-sale*, E.N.E. and W. S. W.	04	30
At *Kildwyn*, E. S. E. and W. N. W.	07	30
At *Kildive*, S. E. and N. W.	09	00
L.		
At *Leigh*, North and South	12	00
At *Lisbon*, N.E. by North and S.W. by South	02	15
At *London*, N. E. and S. W.	03	00
Thwart of *Londey*, and before *Lin*, East by North, and West by South	05	15
At *Lin* half-Tide, at *Londey* East and West	06	00
At *Lime*, East by South, and West by North	06	45
At the *Lizard* by the Land, E.S.E. and W.N.W.	07	30
At *Lambey*, S.E. by East, and N. W. by West	08	15
At *Leystaff*, and thwart of it without the Banks, S. E. by South, and N. W. by North	09	45
In *Leystaff* Road, and at *Long-sand-head*, S.S.E. and N. N. W.	10	30
M.		
Within the *Maes*, and at *Malden* North by East, and South by West	12	45
Before the *Maes* N.N.E. and S. S. W.	01	30
At the *Maes*, and before St. *Matthews* Point N. E. by East, and S.W. by West	03	45
In *Mousehole*, at *Matthews*, and within *Mounts-Bay*, E.N.E. and W.S.W.	04	30
In *Milford*, at *Moonless*, at St. *Maloes*, East by North and West by South	05	15
Between *Mousehole* and *Falmouth*, and in *Milford*-Haven, E.S.E. and W.N.W.	07	30
In St. *Magnes* Sound, and at *Machnels* Castle, S.E. by East, and N.W. by West	08	15

	H.	M.
At the *Isle of Man*, S. E. and N. W.	09	00
Before *Margret*, South by East, and North by West	11	15
N.		
At *Newport*, half-Tide, North and South	12	00
At the West-end of the *Nower*, North by East, and South by West	12	45
Before *New-castle*, and before the River of *Nantz*, N. E. and S. W.	03	00
At *New-castle*, East by North, and W. by S.	05	15
Before S. *Nicholas*, E. by S. and W. by N.	06	45
At the *Needles*, at the *Isle of Wight*, S. E. by East, and N. W. by W.	08	15
All the Coast of *Normandy* and *Picardy*, S. S. E. and N. N. W.	10	30
Between the *Naze* and *Warbead* of *Lower*, South by East, and N. by W.	11	15
O.		
At *Orkneſs*, N. E. and S. W.	03	00
At *Orkney*, S. E. and N. W.	09	00
At *Orfordneſs*, S. E. by South, and North-west by North	09	45
At *Orfordueſs* without the Banks, and between *Orford* & *Orwel-waves*, S. S. E. and N. N. W.	10	30
At *Orfordueſs* within the Sands, South by East, and North by West	11	15
P.		
At *Portſmouth* half-tide, North and South	12	00
At the *Penns*, *Porthus*, and *Pitlou*, N. E. and S. W.	03	00
On the Coaſt of *Portugal*, N. E. by E. and S. W. by W.	03	45
In *Plymouth*, and before *St. Pauls*, East by North, and West by South	05	15
At *St. Pauls* in the Haven, East and West	06	00
Before *Podeſſinks*, East by South, and West by North	06	45
Thwart of *Plymouth*, E. S. E. and W. N. W.	07	30
At the *Race* of *Portland*, S. E. and N. W.	09	00
Q.		
At *Quinborough*, North and South	12	00
R.		
At *Rocheſter*, North by East, and South by West	12	45

	H.	M.
At *Ramkins*, N.N.E. and S.S.W.	01	30
At *Rotterdam*, in *Robin-Hoods* Bay, and from the *Race* to the *Pole-head*, N.E. and S.W.	03	00
At *Roven*, and before *Rochel*, N.E. by E. and S.W. by W.	03	45
In *Ramsey*, East by North and West by South	05	15
In *Russia*, East by South, and West by North	06	45

S.

In the *Sleeve*, between *Ushant* and *Silly*, at the *Shooe*, at the *Spit*, at *South-Hampton*, and along the *Swin*, North and South	12	00
Upon the Coast of *Spain*, and in *Shotland*, N.E. and S.W.	03	00
At *Silly*, and in the *Sound*, at *Staples*, N.E. by East, and S.W. by West	03	45
Before *Scarbrough*, at *Sept. Isles*, without the Haven in the Broad *Sound*, E.N.E. and W.S.W.	04	30
At the Mouth of *Severn*, between *Silly* and the *Lizard*, at the *Spurn*, East by North, and W. by S.	05	15
Without *Silly*, in the Channel, and at *Salcomb*, East and West	06	00
At *Sedmouth*, and at the *Start*, East by South, and West by North	06	45
Off the *Start* in the Channel, E.S.E. and W.N.W.	07	30
Within the *Seyn*, before *Schelhalgh*, and at *Seven-Cliffs*, S.E. and N.W.	09	00
At *Shoram*, S.E. by S. and N.W. by N.	09	45
At *Seyn-head*, S.S.E. and N.N.W.	10	30

T.

Within *Terveer*, N. by E. and S. by W.	12	45
Before *Terveer*, before the River of *Thames*, and at *Tinmouth*, N.N.E. and S.S.W.	01	30
Before the *Tees*, and before the Bay of *Tinmouth*, N.E. and S.W.	03	00
At the Clefts of the *Tessel*, E.N.E. and W.S.W.	04	30
In *Torbay*, and before the *Tessel*, East and West	06	00
In the Road of the *Tessel*, E.S.E. and W.N.W.	07	30
At *Tergou*, S.E. by S. and N.W. by W.	09	45

V.

Before *Vreck*, North and South	12	00

	H.	M.
At *Vſe*, North-eaſt and South-weſt	03	00
Between *Vſhant* and the Main, N. E. by Eaſt, & S. W. by Weſt	03	45
In the *Vourd*, at the Bay within *Vſhant*, E. N. E. and W. S. W.	04	30
VVithout *Vſhant*, Eaſt and VVeſt	06	00
W.		
At *Winchelſey*, North by Eaſt, and South by VVeſt	12	45
At the *Weilings*, and from the Weſt-end of the *Wight*, N. N. E and S. S. W.	01	30
Before the *Weilings*, N. E. by North, and S. W. by South	02	15
In the Sea of *Wales* and *Severn*, E. N. E. & W. S. W.	04	30
In *Wales*, Eaſt by North and Weſt by South	05	15
At *Wells*, at *Weymouth*, and at *Waterford* Eaſt and Weſt	06	00
At *Weymouth* Key, Eaſt by South, and Weſt by North	06	45

	H.	M.
At the *Neſs* by *Wieringhen*, and at *Winterton*, E. S. E. and W. N. W.	07	30
Thwart of the *Iſle of Wight* in the Channel, all within the *Iſle of Wight*, between the *Iſle of Wight* and *Beachy* by the Shore, S. E. by Eaſt, and N. W. by Weſt	08	15
At the Eaſt-end of the *Wight*, and on *Wieringen*-Flats S. E. and N. W.	09	00
Y.		
Before *Yarmouth*, N. N. E. and S. S. W.	01	30
At *Yough-Hall* E. N. E. and VV. S. VV.	04	30
At *Yarmouth* S. E. by Eaſt and N. VV. by VV.	08	15
In *Yarmouth*-Road, and in *Yarmouth* Haven, S. S. E. and N. N. VV.	10	30
Z.		
On the Coaſt of *Zealand* N. N. E. and S. S. VV.	01	30
In the *Zierick-Sea* N. E. and S. VV.	03	00

THe foregoing Table ſhews the time of Full Sea, at the ſeveral places therein mentioned, upon the Full and Change days of the Moon, which for the more ready uſe is put in Alphabetical order.

Example.

Admit the time of Full Sea at *London*, upon the Full and Change days be required.

Look in the Table under the Letter (L) it is found to flow at *London* North-eaſt and South-weſt, (as is vulgarly expreſſed) that is, When it is Full-Sea at *London* upon the Full and Change days, the Moon will be upon the North-eaſt and South-weſt Points of the Compaſs, which, as the ſaid Table ſhews, is at 3 hours.

The Uſe of this, together with the Moons Southing, to find the time of Full-Sea at any time, at any of the ſaid places, ſhall be ſhown below.

To find the Moons Southing.

To find the Southing of the Moon, multiply the Moons Age by 4, and divide the Product by 5, and the Quotient of the Diviſion is the time of Southing.

Note. If the Moons Age exceed 15, reject the ſaid 15, and take the Remainder, with which proceed in ſtead of the Moons Age.

Example.

Suppoſe the time of the Moons Southing be required on the *9th* of *June* 1676. The Moons Age will be found to be 19 days, rejecting 15, the Remainder is 4; which multiplied by 4 makes 16, which divided by 5, gives in the Quotient $3\frac{1}{5}$, or 3 hours 12 minutes, which is the time of the Moons Southing which was required.

Note. Every 1 that remains after Diviſion is 12 minutes.

I ſhall here add a Table of the Moons Southing to every day of her Age.

The

The Table.

Moons Age.	Southing. H.	M.
1	0	48
2	1	36
3	2	24
4	3	12
5	4	00
6	4	48
7	5	36
8	6	24
9	7	12
10	8	00
11	8	48
12	9	36
13	10	24
14	11	12
15	12	00
16	0	48
17	1	36
18	2	24
19	3	12
20	4	00
21	4	48
22	5	36
23	6	24
24	7	12
25	8	00
26	8	48
27	9	36
28	10	24
29	11	12
30	12	00

The Explanation and Use of the Table.

The first and second Columns shew the Moons Age, the third the Southing.

Example.

The Moon being 9 days old, and her Southing required.

In the first Column, under the Title *Moons Age* stands 9; over against it, in the last Column, is 7 hours 12 minutes, the time of Southing required.

Note also, The same Southing serves for 24 days old, as the Table shews.

Thus having got the Moons Southing, proceed to find the time of Full Sea as follows.

Suppose the Moon being 9 days old, the time of Full Sea in the *Downs* required.

By the foregoing Table it appears, that a N.N.VV and S.S.E. Moon makes Full Sea upon the Full and Change days, which (as the said Table shews) is 10 hours 30 minutes; to which adding the Moons Southing at 9 days old, (*viz.*) 7 hours 12 minutes, it makes 17 hours 42 minutes, or 5 hours 42 minutes, rejecting 12 hours.

But to be more exact, use the following Table and Directions.

Having

Having found the time of Full Sea upon the Full and Change days, by the preceding Table for that purpoſe, enter this Table with the Moons Age; againſt which in the laſt Column are the hours and minutes to be added for the time of Full Sea deſired.

Example.

Suppoſe, as before, the Moon being 9 days old, and the time of Full Sea in the *Downs* is required.

A N.N.W. and S.S.W. Moon making Full Sea upon the Full and Change days, which is 10 hours 30 minutes; which being found, enter this Table with the Moons Age 9 days, againſt which ſtands 5 hours 50 minutes; which added to 10 hours 30 minutes, makes 16 hours 20 minutes, or 4 hours 20 minutes, rejecting 12 hours.

The Tide Table.

Moons Age.	Tide. H.	M.
01—16	00—	43
02—17	01—	20
03—18	01—	52
04—19	02—	22
05—20	02—	52
06—21	03—	26
07—22	04—	07
08—23	04—	55
09—24	05—	50
10—25	06—	53
11—26	07—	59
12—27	09—	04
13—28	10—	08
14—29	11—	05
15—30	00—	00

Here follows.

A New and Exact KALENDAR OF

The Suns Place and Declination to every Day of the Year, for the Firſt, Second, Third, and Leap-years, diligently corrected. Likewiſe the Suns Riſing, wherehy may be found the time of Setting, and Length of the Day and Night: Together with the ſouthing of the principal fixed Stars at Midnight.

Months	Week days	Remarkable days & southing of stars at midnight.	First Year. 1677. ☉ pla. D. M.	☉ dec. D. M.	1681.	Second Year. 1678. ☽ pla. D. M.	☉ dec. D. M.	1682.	Third Year. 1679. ☉ pla. D. M.	☉ dec. D. M.	1683.	Leap Year. 1676. ☉ pla. D. M.	☉ dec. D. M.	1680.
			♈	South.		♈	South.		♈	South.		♈	South.	
1	A	Circumcis.	22 02	21 41		21 47	21 44		21 32	21 46		21 17	21 48	
2	B	Sun rise 8.	23 03	21 31		22 48	21 34		22 33	21 36		22 19	21 38	
3	C		24 04	21 21		23 49	21 23		23 35	21 26		23 20	21 28	
4	D		25 05	21 10		24 51	21 13		24 36	21 15		24 21	21 18	
5	E		26 07	20 59		25 52	21 01		25 37	21 04		25 22	21 07	
6	F	Epiphany.	27 08	20 47		26 53	20 50		26 38	20 53		26 23	20 55	
7	G		28 09	20 35		27 54	20 38		27 39	20 41		27 24	20 44	
8	A		29 10	20 23		28 55	20 26		28 40	20 29		28 25	20 32	
9	B	*Sol* in *Aqua*	♒. 11	20 10		29 56	20 13		29 41	20 16		29 26	20 19	
10	C		01 12	19 56		♒. 57	20 00		♒. 42	20 03		♒. 27	20 06	
11	D		02 13	19 43		01 58	19 46		01 43	19 50		01 29	19 53	
12	E		03 14	19 29		02 59	19 32		02 44	19 36		02 30	19 39	
13	F	Sun r. 7.45	04 15	19 15		04 00	19 18		03 45	19 22		03 31	19 25	
14	G		05 16	19 00		05 01	19 04		04 46	19 07		04 32	19 11	
15	A		06 17	18 45		06 02	18 49		05 47	18 52		05 33	18 56	
16	B		07 18	18 30		07 03	18 33		06 48	18 37		06 34	18 41	
17	C		08 19	18 14		8 04	18 18		07 49	18 22		7 35	18 25	
18	D		09 20	17 58		09 05	18 02		08 50	18 06		08 35	18 10	
19	E		10 21	17 42		10 06	17 46		09 51	17 50		09 36	17 54	
20	F		11 22	17 25		11 07	17 29		10 52	17 33		10 37	17 37	
21	G		12 22	17 08		12 08	17 12		11 53	17 16		11 37	17 20	
22	A	Sun r. 7.30	13 23	16 51		13 08	16 55		12 54	16 59		12 39	17 03	
23	B		14 24	16 33		14 09	16 38		13 55	16 42		13 40	16 46	
24	C	*Hydras* heart	15 24	16 15		15 10	16 20		14 55	16 24		14 41	16 30	
25	D	Co. S. *Paul*	16 26	15 57		16 11	16 02		15 56	16 06		15 4	16 11	
26	E		17 26	15 39		17 12	15 40		16 57	15 48		16 42	15 52	
27	F		18 27	15 20		18 12	15 25		17 58	15 29		17 43	15 34	
28	G		19 28	15 01		19 13	15 00		18 58	15 11		18 44	15 15	
29	A		20 28	14 42		20 14	14 47		19 59	14 52		19 44	14 56	
30	B	K. *Charles* M.	21 29	14 23		21 14	14 28		21 00	14 32		21 45	14 37	
31	C	Sun r. 7.14	22 30	14 03		22 15	14 08		22 00	14 13		22 46	14 18	

Month days.	Week days.	Remarkable days & soe-thing of stars at midnight.	First Year. 1677. ☉ pla. D. M	First Year. 1681 ☉ dec D. M	Second Year. 1678. ☉ pla. D. M.	Second Year. 1682. ☉dec. D. M.	Third Year. 1679. ☉ pla. D. M	Third Year. 1683. ☉dec. D. M.	Leap Year. 1676. ☉ pla. D. M.	Leap Year. 1680. ☉ dec. D. M.
			♒.	South.	♒.	South.	♒.	South	♒.	South.
1	D		23 30	13 43	23 16	13 48	23 01	13 53	22 46	13 58
2	E	Purif *Mary*	24 31	13 23	24 16	13 28	24 01	13 33	23 47	13 38
3	F	Lions heart.	25 31	13 03	25 17	13 08	25 02	13 13	24 47	13 18
4	G		26 32	12 43	26 17	12 48	26 02	12 53	25 48	12 58
5	A		27 32	12 22	27 18	12 27	27 03	12 32	26 48	12 37
6	B	Lions neck	28 33	12 01	28 18	12 06	28 03	12 10	27 49	12 16
7	C	Sun r. 7.1.	29 33	11 40	29 19	11 45	29 04	11 50	28 49	11 55
8	D	*Sol* in *Pisces*	♓. 34	11 18	♓. 19	11 24	♓. 04	11 29	29 50	11 34
9	E		01 34	10 57	01 19	1 02	01 05	11 08	♓. 50	11 13
10	F		02 34	10 35	02 20	10 41	02 05	10 46	01 50	10 51
11	G		03 35	10 14	03 20	10 19	03 05	10 24	02 51	10 30
12	A		04 35	09 52	04 20	09 57	04 06	10 02	03 51	10 08
13	B		05 35	09 30	05 20	09 35	05 06	09 40	04 51	9 46
14	C	*Valentine.*	06 35	09 07	06 21	09 13	06 06	09 18	05 51	09 24
15	D	Sun r. 6.46	07 35	08 45	07 21	08 51	07 06	08 56	6 52	09 01
16	E	Lower of	08 36	08 23	08 21	08 28	08 06	08 34	07 52	08 39
17	F	two foremoſt	09 36	08 00	09 21	08 05	09 07	08 11	08 52	08 16
18	G	in □ great	10 36	07 37	10 21	07 43	10 07	07 48	9 52	07 54
19	A	Bear.	11 36	07 14	11 21	07 20	11 07	07 26	10 52	7 31
20	B		12 36	06 51	12 21	06 57	12 07	07 03	11 52	07 08
21	C		13 36	06 28	13 21	06 34	13 07	06 40	12 52	6 45
22	D		14 36	06 05	14 21	06 11	14 07	06 17	13 52	06 22
23	E	Sun r. 6.30	15 36	05 42	15 21	05 48	15 07	05 53	14 52	05 59
24	F	S. *Matthias*	16 36	05 19	16 21	05 25	16 07	05 30	15 52	5 30
25	G		17 35	04 56	17 21	05 01	17 06	05 07	16 52	05 13
26	A		18 35	04 32	18 21	04 38	18 06	04 43	17 52	04 49
27	B		19 35	04 09	19 21	04 14	19 06	04 20	18 52	04 26
28	C		20 35	03 45	20 20	03 51	20 06	03 57	19 51	04 02
29	D								20 51	03 39

When it is Leap-Year, *February* hath 29 days.

Month days.	Week days.	Remarkable days & southing of stars at midnight.	First Year. 1677. ☉ pla.		☉ dec.		Second Year. 1678. ☉ pla.		☉ dec.		Third Year. 1679. ☉ pla.		☉ dec.		Leap Year. 1676. ☉ pla.		☉ dec.	
			D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
			♓.		South.		♓.		South.		♓.		South.		♓.		South.	
1	D	*David.*	21	34	03	22	21	20	03	27	21	06	03	33	21	51	03	15
2	E	Lions Tail	22	34	02	58	22	20	03	04	22	05	03	09	22	50	02	51
3	F	Lower of the	23	34	02	34	23	19	02	40	23	05	02	46	23	50	02	28
4	G	two latter in □ of great	24	33	02	11	24	19	02	16	24	05	02	22	24	50	02	04
5	A	Bear.	25	33	01	47	25	19	01	53	25	04	01	58	25	49	01	41
6	B		26	33	01	23	26	18	01	29	26	04	01	45	26	49	01	17
7	C		27	32	01	00	27	18	01	05	27	03	01	11	27	48	00	53
8	D	Sun r. 6.4	28	32	00	36	28	17	00	42	28	03	00	47	28	48	00	29
9	E	Upper of two	29	31	00	12	29	17	00	18	29	02	00	24	29	47	00	06
10	F	latter in □	♈.	30	*Nor*	12	♈.	16	*Nor*	06	♈.	02	00	00	♈.	47	*Nor*	18
11	G	of gr. Bear.	01	30	00	35	01	15	00	29	01	01	*Nor*	24	01	46	00	42
12	A	*Sol* in *Aries.*	02	29	00	59	02	15	00	53	02	00	00	47	02	45	01	05
13	B		03	28	01	22	03	13	01	17	03	00	01	11	03	44	01	29
14	C		04	28	01	46	04	1	01	40	03	59	01	35	04	44	01	52
15	D		05	27	02	10	05	12	02	04	04	58	01	58	5	43	02	16
16	E		06	26	02	33	06	12	02	27	05	58	02	22	06	42	02	39
17	F		07	25	02	56	07	11	02	51	06	56	02	41	07	41	03	03
18	G	Sun r. 5.44	08	24	03	20	08	10	03	14	07	56	03	09	08	40	03	26
19	A		09	23	03	43	09	09	03	38	08	55	03	32	09	39	03	49
20	B		10	22	04	06	10	08	04	01	09	54	03	55	10	38	04	13
21	C	Last but two	11	21	04	30	11	07	04	24	10	53	04	18	11	37	04	36
22	D	in gr. Bears	12	20	04	53	12	06	04	47	11	52	04	44	12	36	04	59
23	E	Tail.	13	19	05	16	13	05	05	10	12	51	05	05	13	35	05	22
24	F		14	18	05	39	14	04	05	33	13	50	05	28	14	34	05	45
25	G	An. *Mary*	15	17	06	01	15	03	05	56	14	49	05	50	15	33	06	08
26	A	Sun r. 5 28	16	16	06	24	16	02	06	19	15	47	06	13	16	32	06	30
27	B		17	15	06	47	17	01	06	41	16	46	06	36	17	31	06	53
28	C		18	14	07	09	17	59	07	04	17	45	06	58	18	30	07	15
29	D	Virg. Spike.	19	12	07	32	18	58	07	26	18	44	07	21	19	28	07	38
30	E	Last but one	20	11	07	54	19	57	07	49	19	43	07	43	20	27	08	00
31	F	in gr. Bears Tail.	21	10	08	16	20	55	08	11	20	41	08	05	21	26	08	22

Month days.	Week days.	Remarkable days & southing of stars at midnight.	First Year. 1677. ☉ pla. D. M. ♈	First Year. 1681. ☉ dec. D. M. North.	Second Year. 1678. ☉ pla. D. M. ♈	Second Year. 1682. ☉ dec. D. M. North.	Third Year. 1679. ☉ pla. D. M. ♈	Third Year. 1683. ☉ dec. D. M. North.	Leap Year. 1676. ☽ pla. D. M. ♈	Leap Year. 1680. ☽ dec. D. M. North.
1	G	Sun r. 5. 15	22 08	08 38	21 54	08 33	21 40	08 27	22 24	08 44
2	A		23 07	09 00	22 53	08 55	22 38	08 49	23 23	09 06
3	B		24 05	09 22	23 51	09 16	23 37	09 11	24 21	09 27
4	C	Last in great Bears Tail.	25 04	09 43	24 50	09 38	24 36	09 33	25 20	09 49
5	D		26 02	10 04	25 48	09 59	25 34	09 54	26 18	10 10
6	E		27 01	10 26	26 47	10 21	26 33	10 15	27 17	10 31
7	F		27 59	10 47	27 45	10 42	27 31	10 37	28 15	10 52
8	G		28 58	11 08	28 44	11 03	28 29	10 57	29 14	11 13
9	A	Sun r. 5. 1	29 56	11 28	29 42	11 23	29 28	11 18	♉. 12	11 34
10	B	*Sol* in *Taur.*	♉. 55	11 49	♉. 40	11 44	♉. 26	11 39	01 10	11 54
11	C	Dragons tail.	01 53	12 09	01 39	12 05	01 25	11 59	02 09	12 15
12	D	Arcturus.	02 51	12 29	02 37	12 24	02 23	12 19	03 07	12 35
13	E		03 49	12 49	03 35	12 44	03 21	12 39	04 05	12 54
14	F		04 48	13 09	04 33	13 04	04 19	12 59	05 03	13 14
15	G		05 46	13 28	05 32	13 24	05 18	13 19	06 02	13 34
16	A		06 44	13 47	06 30	13 43	06 16	13 38	07 00	13 53
17	B		07 42	14 07	07 28	14 02	07 14	13 58	07 58	14 12
18	C		08 40	14 25	08 26	14 21	08 12	14 16	08 56	14 30
19	D	Sun.r.4.45	09 38	14 44	09 24	14 39	09 10	14 35	09 54	14 49
20	E	Southermost	10 36	15 02	10 22	14 58	10 08	14 53	10 52	15 07
21	F	scale of Lib.	11 34	15 20	11 20	15 16	11 06	15 12	11 50	15 25
22	G		12 22	15 38	12 18	15 34	12 04	15 30	12 48	15 43
23	A		13 30	16 56	13 16	15 52	13 02	15 47	13 46	16 00
24	B		14 28	16 13	14 14	16 09	14 00	16 05	14 44	16 18
25	C	*Mark* Eva.	15 26	16 30	15 12	16 26	14 58	16 22	15 42	16 35
26	D	Upper of the two foremost	16 24	16 47	16 10	16 43	15 56	16 39	16 40	16 51
27	E	in □ of the	17 22	17 03	17 08	16 59	16 54	16 55	17 38	17 08
28	F	little Bear. Northermost	18 20	17 20	18 06	17 16	17 52	17 12	18 36	17 24
29	G	Scale of Lib.	19 18	17 36	19 04	17 32	18 50	17 28	19 33	17 40
30	A	Sun r.4.24	20 15	17 51	20 01	17 47	19 47	17 44	20 31	17 55

Month days.	Week days.	Remarkable days & southing of stars at midnight.	First Year. 1677. ☉ pla.	First Year. 1681. ☉ dec.	Second Year. 1678. ☉ pla.	Second Year. 1682. ☉ dec	Third Year. 1679. ☉ pla.	Third Year. 1683 ☉ dec	Leap Year. 1676. ☉ pla	Leap Year. 1680 ☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M	D. M	D. M	D. M.
			♉.	North.	♉.	North.	♉.	North.	♉.	North.
1	B	*Phil.& Ja.*	21 13	18 07	20 59	18 03	20 45	17 59	21 29	18 11
2	C		22 11	18 22	21 57	18 18	21 43	18 14	22 27	18 26
3	D	Brightest in the Crown.	23 09	18 36	22 55	18 33	22 41	18 29	23 24	18 40
4	E	Brightest in Serp. Neck.	24 06	18 51	23 52	18 47	23 38	18 44	24 22	18 55
5	F		25 04	19 05	24 50	19 01	24 36	18 58	25 20	19 09
6	G	Sun r. 4. 15	26 02	19 19	25 48	19 15	25 34	19 12	26 17	19 22
7	A		26 59	19 32	26 45	19 29	26 31	19 26	27 15	19 36
8	B		27 57	19 45	27 43	19 42	27 29	19 39	28 13	19 49
9	C	Scorpions	28 54	19 58	28 40	19 55	28 26	19 52	29 10	20 02
10	D	Forehead.	29 52	20 11	29 38	20 08	29 24	20 05	♊. 08	20 14
11	E	*Sol* in *Gem.*	♊. 49	20 23	♊. 36	20 20	♊. 22	20 17	01 05	20 26
12	F		01 47	20 34	01 33	20 32	01 19	20 29	02 03	20 38
13	G		02 44	20 46	02 31	20 43	02 17	20 40	03 00	20 49
14	A		03 42	20 57	03 28	20 54	03 14	20 51	03 58	21 00
15	B	Scorpions	04 39	21 08	04 26	21 05	04 12	21 03	04 55	21 11
16	C	Heart.	05 37	21 18	05 23	21 16	05 09	21 13	05 53	21 21
17	D	Sun rise 4.	06 34	21 28	06 20	21 26	06 07	21 23	06 50	21 31
18	E		07 32	21 38	07 18	21 35	07 04	21 33	07 47	21 40
19	F		08 29	21 47	08 15	21 45	08 01	21 42	08 45	21 49
20	G		09 27	21 56	09 13	21 54	08 59	21 51	09 42	21 58
21	A		10 24	22 04	10 10	22 02	09 56	22 00	10 40	22 07
22	B		11 21	22 12	11 07	22 10	10 53	22 08	11 37	22 14
23	C		12 19	22 20	12 05	22 18	11 51	22 16	12 34	22 22
24	D		13 16	22 27	13 02	22 26	12 48	22 24	13 32	22 29
25	E		14 13	22 34	13 59	22 33	13 45	22 31	14 29	22 36
26	F		15 11	22 41	14 57	22 39	14 43	22 38	15 26	22 43
27	G		16 08	22 47	15 54	22 46	15 40	22 44	16 24	22 49
28	A		17 05	22 53	16 51	22 52	16 37	22 50	17 21	22 54
29	B	K. *Charles* 2d	18 02	22 58	17 48	22 57	17 35	22 56	18 18	22 59
30	C	Nat. & Ret.	19 00	23 03	18 46	23 02	18 32	23 01	19 15	23 04
31	D	Sun r. 3. 51	19 56	23 08	19 43	23 07	19 29	23 06	20 13	23 09

Month days.	Week days.	Remarkable days & southing of stars at midnight.	First Year. 1677. ☉ pla.	First Year. 1681. ☉ dec.	Second Year. 1678. ☉ pla.	Second Year. 1682. ☉ dec.	Third Year. 1679. ☉ pla.	Third Year. 1683. ☉ dec.	Leap Year. 1676. ☉ pla.	Leap Year. 1680. ☉ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			♊	North	♊	North.	♊	North.	♊	North.
1	E		20 54	23 11	20 40	23 10	20 26	23 09	21 10	23 12
2	F		21 51	23 15	21 37	23 14	21 24	23 13	22 07	23 16
3	G	Fight with *Dutch* 1652	22 49	23 18	22 35	23 17	22 21	23 16	23 04	23 19
4	A	1665.	23 46	23 21	23 32	23 20	23 18	23 20	24 01	23 22
5	B		24 43	23 23	24 29	23 23	24 15	23 22	24 59	23 24
6	C		25 40	23 26	25 26	23 25	25 12	23 25	25 56	23 26
7	D		26 37	23 27	26 23	23 27	26 10	23 27	26 53	23 28
8	E		27 34	23 29	27 21	23 28	27 07	23 28	27 50	23 29
9	F		28 32	23 29	28 18	23 29	28 04	23 29	28 47	23 30
10	G	Sun r. 3 48	29 29	23 30	29 15	23 30	29 01	23 30	29 45	23 30
11	A	*Sol* in *Cancri*	♋ 26	23 30	♋ 12	23 30	29 58	23 30	♋ 42	23 30
12	B		01 23	23 30	01 09	23 30	♋ 56	23 30	01 39	23 29
13	C		02 20	23 29	02 06	23 29	01 53	23 29	02 36	23 28
14	D		03 18	23 28	03 04	23 28	02 50	23 28	03 33	23 27
15	E		04 15	23 26	04 01	23 26	03 47	23 27	04 30	23 25
16	F		05 12	23 24	04 58	23 25	04 44	23 25	05 27	23 23
17	G	Brightest in the Harp.	06 09	23 22	05 55	23 22	05 41	23 23	06 25	23 21
18	A		07 06	23 19	06 52	23 19	06 38	23 20	07 22	23 18
19	B		08 03	23 16	07 49	23 16	07 36	23 17	08 19	23 15
20	C		09 00	23 12	08 47	23 13	08 33	23 14	09 16	23 11
21	D	Sun r. 3. 50	09 58	23 08	09 44	23 09	09 30	23 10	10 13	23 07
22	E		10 55	23 03	10 41	23 04	10 27	23 06	11 10	23 02
23	F		11 52	22 58	11 38	23 00	11 24	23 01	12 08	22 57
24	G	*John Bap.*	12 49	22 53	12 35	22 54	12 21	22 56	13 05	22 52
25	A		13 46	22 48	13 32	22 49	13 19	22 50	14 02	22 46
26	B		14 43	22 41	14 30	22 43	14 16	22 44	14 59	22 40
27	C		15 41	22 35	15 27	22 37	15 13	22 38	15 56	22 33
28	D		16 38	22 28	16 24	22 30	16 10	22 32	16 53	22 26
29	E	*Peter* Ap.	17 35	22 21	17 21	22 23	17 07	22 25	17 51	22 19
30	F		18 32	22 13	18 18	22 15	18 04	22 17	18 48	22 11

Month days.	Week days.	Remarkable days & southing of stars at midnight.	First Year. 1677. ☉ pla. D. M.	☉ dec. D. M.	Second Year. 1678. ☉ pla. D. M.	☉ dec. D. M.	Third Year. 1679. ☉ pla. D. M.	☉ dec D. M	Leap Year. 1676. ☉ pla D. M	☉ dec. D. M.
			♋.	North.	♋.	North.	♋.	North.	♋.	North.
1	G	Sun r.3.57	19 29	22 04	19 15	22 06	19 02	22 08	19 45	22 02
2	A		20 26	21 56	20 13	21 58	19 59	22 00	20 42	21 54
3	B		21 24	21 47	21 10	21 49	20 56	21 52	21 39	21 45
4	C	Brightest between the	22 21	21 38	22 07	21 40	21 53	21 43	22 37	21 36
5	D	Eagles	23 18	21 29	23 04	21 31	22 50	21 33	23 34	21 26
6	E	shoulders.	24 15	21 19	24 02	21 21	23 48	21 24	24 31	21 16
7	F		25 13	21 09	24 59	21 11	24 45	21 14	25 28	21 06
8	G		26 10	20 58	25 56	21 01	25 42	21 03	26 26	20 55
9	A		27 07	20 47	26 53	20 50	26 39	20 52	27 23	20 44
10	B		28 04	20 36	27 51	20 39	27 37	20 41	28 20	20 33
11	C		29 02	20 24	28 48	20 27	28 34	20 30	29 17	20 21
12	D		29 59	20 12	29 45	20 15	29 31	20 18	♌. 15	20 09
13	E	*Sol* in *Leo*.	♌. 56	20 00	♌. 42	20 03	♌. 29	20 06	01 12	19 56
14	F		01 54	19 47	01 40	19 50	01 26	19 53	02 09	19 44
15	G		02 51	19 34	02 37	19 37	02 23	19 41	03 07	19 31
16	A		03 48	19 21	03 34	19 24	03 21	19 27	04 04	19 17
17	B	Sun r.4.15	04 46	19 07	04 32	19 11	04 18	19 14	05 01	19 03
18	C	Swans Tail	05 43	18 53	05 29	18 57	05 15	19 00	05 59	18 49
19	D	Dog-days	06 40	18 39	06 27	18 43	06 13	18 46	06 56	18 35
20	E	begin.	07 38	18 24	07 24	18 28	07 10	18 32	07 54	18 20
21	F		08 35	18 10	08 20	18 13	08 08	18 17	08 51	18 06
22	G		09 33	17 55	09 19	17 58	09 05	18 02	09 48	17 50
23	A		10 30	17 39	10 16	17 43	10 02	17 47	10 46	17 35
24	B		11 28	17 23	11 14	17 27	11 00	17 31	11 43	17 19
25	C	*James* Ap.	12 25	17 07	12 11	17 11	11 57	17 15	12 41	17 03
26	D	Sun r.4.30	13 24	16 51	13 09	16 54	12 55	16 59	13 38	16 46
27	E		14 20	16 34	14 06	16 38	13 52	16 42	14 36	16 30
28	F		15 18	16 18	15 04	16 22	14 50	16 26	15 34	16 13
29	G		16 15	16 00	16 01	16 05	15 48	16 09	16 31	15 56
30	A		17 13	15 43	16 59	15 47	16 45	15 52	17 29	15 38
31	B		18 11	15 26	17 57	15 30	17 43	15 34	18 26	15 21

Month days.	Week days.	Remarkable days, & southing of stars at Midnight.	First Year. 1677. ☉ pla.		1681. ☉ dec.		Second Year 1678. ☉ pla.		1682. ☉ dec.		Third Year. 1679. ☉ pla.		1683. ☉ dec		Leap Year. 1676. ☉ pla.		1680. ☉ dec.	
			D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M	D.	M.
					North.				North.				North.				North.	
1	C		♎ 19	08	15	08	18	54	15	12	18	40	15	16	19	24	15	03
2	D	Pegasus Mouth.	20	06	14	49	19	52	14	54	19	38	14	58	20	22	14	44
3	E		21	04	14	31	20	50	14	36	20	36	14	40	21	19	14	26
4	F	Sun r. 4.45	22	01	14	12	21	47	14	17	21	33	14	22	22	17	14	07
5	G		22	59	13	54	22	45	13	58	22	31	14	03	23	15	13	48
6	A		23	57	13	35	23	43	13	39	23	29	13	44	24	13	13	29
7	B		24	55	13	15	24	41	13	20	24	27	13	25	25	10	13	10
8	C		25	52	12	56	25	38	13	01	25	24	13	05	26	08	12	51
9	D		26	50	12	36	26	36	12	41	26	22	12	46	27	06	12	31
10	E		27	48	12	16	27	34	12	21	27	20	12	26	28	04	12	11
11	F		28	46	11	56	28	32	12	01	28	18	12	06	29	02	11	51
12	G		29	44	11	36	29	30	11	41	29	16	11	46	30	00	11	30
13	A	*Sol* in *Virg.*	♍ 42		11	16	♍ 28		11	21	♍ 14		11	26	♍ 58		11	10
14	B	Sun r. 5.2.	01	40	10	55	01	26	11	00	01	12	11	05	01	56	10	49
15	C		02	38	10	34	02	24	10	39	02	10	10	44	02	54	10	28
16	D		03	36	10	13	03	22	10	18	03	08	10	23	03	52	10	07
17	E		04	34	09	52	04	20	09	57	04	06	10	02	04	50	09	46
18	F		05	32	09	31	05	18	09	36	05	04	09	14	05	48	09	25
19	G		06	30	09	09	06	16	09	15	06	02	09	20	06	46	09	03
20	A		07	28	08	48	07	14	08	53	07	00	08	58	07	44	08	42
21	B	Fomahant.	08	27	08	26	08	12	08	31	07	58	08	37	08	42	08	20
22	C		09	25	08	04	09	11	08	09	08	57	08	15	09	41	07	58
23	D		10	23	07	42	10	09	07	47	09	55	07	53	10	39	07	36
24	E	*Barthol* Ap	11	21	07	20	11	07	07	25	10	53	07	31	11	37	07	14
25	F	First in Pegasus Wing, and begin. of his Leg.	12	19	06	58	12	05	07	03	11	51	07	09	12	35	06	52
26	G		13	18	06	35	13	04	06	41	12	50	06	46	13	34	06	29
27	A		14	16	06	13	14	02	06	18	13	48	06	24	14	32	06	07
28	B	Dog-days end.	15	15	05	50	15	00	05	56	14	46	06	01	15	30	05	44
29	C	Sun r. 5.32	16	13	05	28	15	59	05	33	15	45	05	39	16	29	05	22
30	D		17	11	05	05	16	57	05	10	16	43	05	16	17	27	04	59
31	E		18	10	04	42	17	56	04	48	17	42	04	53	18	26	04	36

Month days.	Week days.	Remarkable days & southing of stars at midnight.	First Year. 1577. 1681. ☉ pla.	☉ dec	Second Year. 1678. 1682. ☉ pla	☽ dec.	Third Year. 1679. 1683. ☉ pla.	☉ dec.	Leap Year. 1676. 1680. ☉ pla.	☽ dec.
			D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.	D. M.
			♍.	North.	♍.	North.	♍.	North.	♍.	North.
1	F	Sun r. 5.37	19 08	04 19	18 54	04 25	18 40	04 30	19 24	04 13
2	G	*Lon.* burnt 66	20 07	03 56	19 53	04 02	19 39	04 07	20 23	03 50
3	A	*O. Crom.* died	21 06	03 33	20 51	03 39	20 37	03 44	21 22	03 27
4	B	1658.	22 04	03 10	21 50	03 15	21 36	03 21	22 20	03 03
5	C		23 03	02 47	22 49	02 52	22 34	02 58	23 19	02 40
6	D		24 01	02 23	23 47	02 29	23 33	02 35	24 17	02 17
7	E		25 01	02 00	24 46	02 06	24 32	02 11	25 16	01 54
8	F		25 59	01 37	25 45	01 42	25 30	01 48	26 15	01 30
9	G		26 58	01 13	26 43	01 19	26 29	01 25	27 14	01 07
10	A	Andromeda's Head	27 57	00 50	27 42	00 56	27 28	01 01	28 13	00 43
11	B	End of Pegasus's Wing.	28 55	00 26	28 41	00 32	28 27	00 38	29 11	00 20
12	C		29 54	00 03	29 40	00 09	29 26	00 14	♎. 10	*Son.* 31
13	D	*Sol* in *Libra*.	♎. 53	*Son.* 21	♎. 39	*Son.* 15	♎. 25	*Son.* 09	01 09	00 27
14	E	Sun r. 6.2.	01 52	00 44	01 38	00 38	01 24	00 33	02 08	00 51
15	F		02 51	01 08	02 37	01 02	02 23	00 56	03 07	01 14
16	G		03 50	01 31	03 36	01 25	03 22	01 20	04 06	01 38
17	A		04 49	01 55	04 35	01 49	04 21	01 43	05 05	02 01
18	B		05 48	02 18	05 34	02 12	05 20	02 07	06 04	02 25
19	C		06 47	02 42	06 33	02 36	06 19	02 30	07 04	02 48
20	D		07 47	03 05	07 32	02 59	07 18	02 54	08 03	03 11
21	E	*Matth.* Ev.	08 46	03 28	08 31	03 23	08 17	03 17	09 02	03 35
22	F	Pole Star.	09 45	03 52	09 31	03 46	09 16	03 40	10 01	03 58
23	G		10 44	04 15	10 30	04 09	10 16	04 04	11 00	04 21
24	A		11 44	04 38	11 29	04 33	11 15	04 27	12 00	04 45
25	B	Sun r. 6.24	12 43	05 02	12 29	04 56	12 14	04 50	12 59	05 08
26	C	Southermost	13 42	05 25	13 28	05 19	13 14	05 14	13 59	05 31
27	D	in Andromeda's girdle.	14 42	05 48	14 27	05 42	14 13	05 37	14 58	05 54
28	E		15 41	06 11	15 27	06 05	15 12	06 00	15 57	06 17
29	F	*Mic.* Arch.	16 41	06 34	16 26	06 28	16 12	06 23	16 57	06 40
30	G		17 40	06 57	17 26	06 51	17 11	06 46	17 56	07 03

Month days.	Week days.	Remarkable days & southing of stars at midnight	First Year. 1677. ☉ pla. D. M.	1681. ☉ dec. D. M.	Second Year. 1678. ☉ pla. D. M.	1682. ☉ dec. D. M.	Third Year. 1679. ☉ pla. D. M.	1683. ☉ dec. D. M.	Leap Year. 1676. ☉ pla. D. M.	1680. ☉ dec. D. M.
			♎.	South.	♎.	South.	♎.	South.	♎.	South.
1	A		18 40	07 19	18 25	07 14	18 11	07 08	18 56	07 26
2	B		19 39	07 42	19 25	07 36	19 10	07 31	19 56	07 48
3	C		20 39	08 04	20 25	07 59	20 10	07 54	20 55	08 11
4	D		21 39	08 27	21 24	08 22	21 10	08 16	21 55	08 33
5	E	Sun r.6.44	22 38	08 49	22 24	08 44	22 09	08 38	22 55	08 55
6	F		23 38	09 11	23 24	09 06	23 09	09 01	23 54	09 17
7	G		24 38	09 33	24 23	09 28	24 09	09 23	24 54	09 39
8	A		25 38	09 55	25 23	09 50	25 09	09 45	25 54	10 01
9	B		26 37	10 17	26 23	10 12	26 08	10 07	26 54	10 23
10	C		27 37	10 39	27 23	10 34	27 08	10 28	27 54	10 45
11	D	*An'romedas*	28 37	11 00	28 23	10 55	28 08	10 50	28 54	11 06
12	E	Southermost Foot.	29 37	11 22	29 23	11 16	29 08	11 11	29 53	11 27
13	F	*Sol* in *Scorp.*	m. 37	11 43	m. 23	11 38	m. 08	11 32	m. 53	11 48
14	G	Sun r. 7.1	01 37	12 04	01 23	11 59	01 08	11 53	01 53	12 09
15	A		02 37	12 24	02 23	12 19	02 08	12 14	02 53	12 30
16	B		03 37	12 45	03 23	12 40	03 08	12 35	03 54	12 50
17	C		04 37	13 05	04 23	13 0	04 08	12 55	04 54	13 11
18	D	*Luke* Ev.	05 37	13 25	05 23	13 21	05 08	13 16	05 54	13 31
19	E		06 38	13 45	06 23	13 41	06 08	13 36	06 54	13 51
20	F		07 38	14 05	07 23	14 00	07 09	13 56	07 54	14 10
21	G		08 38	14 25	08 23	14 20	08 09	14 15	08 54	14 30
22	A		09 38	14 44	09 24	14 39	09 09	14 34	09 55	14 49
23	B		10 39	15 03	10 24	14 58	10 09	14 54	10 55	15 08
24	C		11 39	15 22	11 24	15 17	11 10	15 13	11 56	15 27
25	D		12 39	15 40	12 25	15 36	12 10	15 31	12 56	15 45
26	E	Whales Jaw	13 40	15 59	13 25	15 54	13 10	15 50	13 56	16 03
27	F		14 40	16 17	14 25	16 12	14 11	16 08	14 56	16 21
28	G	*Sim. & Jude.*	15 40	16 34	15 26	16 30	15 11	16 25	15 57	16 39
29	A	Perseus	16 41	16 52	16 26	16 48	16 12	16 43	16 57	16 56
30	B	right side.	17 41	17 09	17 27	17 05	17 12	17 01	17 58	17 13
31	C	Sunr 7.32	17 26	17 26	18 27	17 22	18 13	17 18	18 58	17 30

Month days.	Week days.	Remarkable days, & southing of stars at midnight.	First Year. 1677. ☉ pla. D. M.	First Year. 1681. ☉ dec. D. M.	Second Year. 1678. ☉ pla. D. M.	Second Year. 1682. ☉ dec. D. M.	Third Year. 1679. ☉ pla. D. M.	Third Year. 1683. ☉ dec. D. M.	Leap Year. 1676. ☉ pla. D. M.	Leap Year. 1680. ☉ dec. D. M.
			m.	South.	m.	South.	m.	South.	m.	South.
1	D	All Saints	19 42	17 43	19 28	17 38	19 13	17 34	19 59	17 47
2	E		20 43	17 59	20 28	17 55	20 14	17 51	21 00	18 03
3			21 44	18 15	21 29	18 11	21 14	18 07	22 00	18 19
4			22 44	18 30	22 30	18 26	22 15	18 23	23 01	18 34
5		Powder Plot.	23 45	18 45	23 30	18 42	23 15	18 38	24 01	18 50
6			24 46	19 00	24 31	18 57	24 16	18 53	25 02	19 04
7			25 46	19 15	25 32	19 12	25 17	19 08	26 03	19 19
8		Sun r. 7. 44	26 47	19 29	26 32	19 26	26 18	19 22	27 04	19 33
9	E		27 48	19 43	27 33	19 40	27 18	19 37	28 04	19 47
10	F		28 49	19 57	28 34	19 54	28 19	19 50	29 05	20 00
11	G		29 49	20 10	29 35	20 07	29 20	20 04	☉. 06	20 14
12	A	*Sol* in *Sagit.*	☉. 50	20 23	☉. 35	20 20	☉. 20	20 17	01 07	20 26
13	B		01 51	20 35	01 36	20 32	01 22	20 29	02 08	20 39
14	C		02 52	20 47	02 37	20 44	02 22	20 41	03 08	20 51
15	D		03 53	20 59	03 38	20 56	03 23	20 53	04 09	21 02
16	E		04 54	21 10	04 39	21 08	04 24	21 05	05 10	21 13
17	F		05 55	21 21	05 40	21 19	05 25	21 16	06 11	21 24
18	G	Bulls Eye, or *Aldebaran.*	06 56	21 32	06 41	21 29	06 26	21 27	07 12	21 34
19	A		07 57	21 42	07 42	21 39	07 27	21 37	08 13	21 44
20	B	Sun rise 8	08 58	21 51	08 43	21 49	08 28	21 47	09 14	21 54
21	C		09 59	22 01	09 44	21 58	09 29	21 56	10 15	22 03
22	D		11 00	22 09	10 45	22 07	10 30	22 05	11 16	22 12
23	E		12 01	22 18	11 46	22 16	11 31	22 14	12 17	22 20
24	F		13 02	22 26	12 47	22 24	12 32	22 22	13 18	22 28
25	G	*Capella*, or Goat.	14 03	22 33	13 48	22 31	13 33	22 30	14 19	22 35
26	A		15 04	22 40	14 49	22 39	14 34	22 37	15 20	22 42
27	B	*Orions* left Foot.	16 05	22 47	15 50	22 45	15 35	22 44	16 22	22 49
28	C		17 06	22 53	16 51	22 52	16 36	22 50	17 23	22 55
29	D	End of Bulls Horn.	18 07	22 59	17 52	22 57	17 37	22 56	18 24	23 00
30	E	*Andr.* Ap.	19 08	23 04	18 53	23 03	18 39	23 01	19 25	23 05

Month days.	Week days.	Remarkable days, & southing of stars at Midnight.	First Year. 1677. ☉ pla. D. M.	First Year. 1681. ☉ dec. D. M.	Second Year 1678. ☽ pla. D. M.	Second Year 1682. ☽ dec. D. M.	Third Year. 1679. ☽ pla. D. M.	Third Year. 1683. ☽ dec. D. M.	Leap Year. 1676. ☽ pla. D. M.	Leap Year. 1680 ☽ dec. D. M.
			♐.	South.	♐.	South.	♐.	South.	♐.	South.
1	F	First in *Orions* Belt.	20 09	23 08	19 55	23 07	19 40	23 05	20 26	23 09
2	G		21 11	23 12	20 56	23 11	20 41	23 10	21 27	23 13
3	A	Last in *Orions* Belt.	22 12	23 16	21 57	23 15	21 42	23 14	22 28	23 17
4	B		23 13	23 29	22 58	23 19	22 43	23 18	23 30	23 20
5	C	Sun r. 8. 11	24 14	23 22	23 59	23 22	23 44	23 21	24 31	23 23
6	D	*Orions* right	25 15	23 25	25 00	23 24	24 46	23 24	25 32	23 25
7	E	shoulder, &	26 17	23 27	26 02	23 26	25 47	23 26	26 33	23 27
8	F	*Auriga's* right shoul.	27 18	23 28	27 03	23 28	26 48	23 28	27 34	23 29
9	G		28 19	23 29	28 04	23 29	27 49	23 29	28 36	23 29
10	A		29 20	23 30	29 05	23 30	28 50	23 30	29 37	23 30
11	B	*Sol* in *Capric*	♑ 21	23 30	♑. 07	23 30	29 52	23 30	♑. 38	23 30
12	C	Sun r. 8. 12	01 23	23 30	01 08	23 30	♑. 53	23 30	01 39	23 29
13	D	Foot of the	02 24	23 29	02 09	23 29	01 54	23 29	02 40	23 28
14	E	great Dog.	03 25	23 28	03 10	23 28	02 55	23 28	03 42	23 27
15	F	Bright foot	04 26	23 26	04 11	23 26	03 57	23 27	04 43	23 25
16	G	of *Gemini*.	05 28	23 23	05 13	23 24	04 58	23 25	05 44	23 23
17	A	Sun r. 8. 11	06 29	23 21	06 14	23 21	05 59	23 22	06 45	23 20
18	B	Mouth of the	07 30	23 17	07 15	23 18	07 00	23 19	07 47	23 16
19	C	great Dog,	08 31	23 14	08 16	23 15	08 02	23 16	08 48	23 13
20	D	or *Syrius*.	09 33	23 10	09 18	23 11	09 03	23 12	09 49	23 08
21	E	*Thomas* Ap	10 34	23 05	10 19	23 06	10 04	23 07	10 50	23 04
22	F		11 35	23 00	11 20	23 01	11 05	23 02	11 52	22 58
23	G		12 36	22 54	12 21	22 56	12 07	22 57	12 53	22 53
24	A		13 27	22 48	13 23	22 50	13 08	22 51	13 54	22 47
25	B	Nat. *Christ*	14 39	22 42	14 24	22 44	14 09	22 45	14 55	22 40
26	C	St. *Stephen*	15 40	22 35	15 25	22 37	15 10	22 39	15 57	22 33
27	D	*John* Evan.	16 41	22 28	16 26	22 30	16 11	22 31	16 58	22 26
28	E	*Innocents*.	17 42	22 20	17 27	22 22	17 13	22 24	17 59	22 18
29	F	Castor.	18 44	22 12	18 29	22 14	18 14	22 16	19 00	22 09
30	G	Little Dogs thigh *Pollux*.	19 45	22 03	19 30	22 05	19 15	22 07	20 01	22 01
31	A	Sun r. 8. 1.	20 46	21 54	20 31	21 56	20 16	21 59	21 03	21 52

A Table of the Variation of the Suns Declination, to every 15 degrees of Longitude from the Meridian of *London*.

Degrees of Longitude from the Meridian of London.

Diff. Variat.	D. 15	D. 30	D. 45	D 60	D 75	D. 90	D. 105	D. 120	D. 135	D. 150	D. 165	D. 180
M.	M	M	M	M	M.	M	M.	M.	M.	M.	M.	M.
2	00	00	00	00	00	00	01	01	01	01	01	01
3	00	00	00	00	01	01	01	01	01	01	01	01
4	00	00	00	01	01	01	01	01	01	02	02	02
5	00	00	01	01	01	01	01	02	02	02	02	02
6	00	00	01	01	01	01	02	02	02	02	03	03
7	00	01	01	01	01	02	02	03	03	03	03	03
8	00	01	01	01	02	02	02	03	03	03	04	04
9	00	01	01	01	02	02	03	03	03	04	04	04
10	00	01	01	02	02	02	03	03	04	04	05	05
11	00	01	01	02	02	03	03	04	04	05	05	05
12	00	01	01	02	02	03	03	04	04	05	05	06
13	01	01	02	02	03	03	04	04	05	05	06	06
14	01	01	02	02	03	03	04	05	05	06	06	07
15	01	01	02	02	03	04	04	05	06	06	07	07
16	01	01	02	03	03	04	05	05	06	07	07	08
17	01	01	02	03	04	04	05	06	06	07	08	08
18	01	01	02	03	04	04	05	06	07	07	08	09
19	01	02	02	03	04	05	06	06	07	08	09	09
20	01	02	02	03	04	05	06	07	07	08	09	10
21	01	02	03	03	04	05	06	07	08	09	10	10
22	01	02	03	04	05	05	06	07	08	09	10	11
23	01	02	03	04	05	06	07	08	09	10	11	11
24	01	02	03	04	05	06	07	08	09	10	11	12

Explanation of the Kalendar.

IN every Page there is eleven Columns; the first shews the Day of the Month; the second the Days of the Week, expressed by the Letters A, B, C, &c. the third, the Southing of several Stars at Midnight, at which time the said Stars are to be observed, thereby to find the Latitude; in the same Column is given the time of Sun-Rising (and by subtracting the time of Rising from 12 hours, the time of Setting) to about every Quarter of an hours difference: The eight following Columns shew the Suns Place and Declination for the First, Second, Third and Leap-Years, according to their respective Titles.

For the more ready knowing of Leap-Year, the following Table is inserted, where it is found by inspection, as also the First, Second, or Third Years after Leap-Year.

The Table.

First Year.	Second Year.	Third Year.	Leap-Year.
1673	1674	1675	1676
1677	1678	1679	1680
1681	1682	1683	1684
1685	1686	1687	1688
1689	1690	1691	1692
1693	1694	1695	1696
1697	1698	1699	1700
1701	1702	1703	1704

The Use of the Kalendar.

To find the Day of the Week or Month for any time past, or to come, by the Kalendar:

First, Find the Dominical Letter for the Year, then proceed as follows.

Example

Example 1.

Suppoſe it were required to find what day of the month was the ſecond Wedneſday in *March* 1647.

Having found the Dominical Letter, which is C, turn to the month of *March*, and account C for Sunday, three days downward from which is F for Wedneſday, and the 2*d* Wedneſday is the 17*th* day of *March*, as was required.

Examle 2.

What day of the Week will the ſecond of *September* be in the Year 1676?

This Year being Leap-Year, hath two Dominical Letters, B and A; the firſt ſerving from the firſt of *January* to the 25*th* of *February*; the latter from thence to the Years end.

Wherefore looking againſt the ſecond of *September*, there ſtands G, which (accounting A for Sunday) repreſents Saturday, which is the day of the Week required.

Note, that the *Gregorian* or *Forreign Account* begins ten days before ours, ſo that our firſt of *January* is their 11, our 11 their 21, our 21 their 31, our 24 of *February* their 6 of *March*; but in Leap-Year, our 24 of *February* is their 5 of *March*, becauſe then *February* hath 29 days.

To find the Suns Place and Declination by the Kalendar.

Example 1.

Suppoſe the Suns Place and Declination to be required on the 10*th* of *January* 1679, being the third after Leap-Year.

In the month of *January*, in the firſt Column, look the Day of the month, over againſt which, under the third year, ſtands ♒ 42; that is, the Suns place is in 42 min. of *Aquarius*. In the next Column under the ſaid year, ſtands 20 03 under the Title *South*, which ſhews the Declination to be 20 deg. 03 min. ſoutherly; and this ſerves either for the Year 1679 or 1683 on the ſaid 10*th* of *January*, being the third after Leap-Year.

Example

Example 2.

Suppoſe the Suns Place or Declination to be required on the 10*th* of *March* 1676. being Leap Year.

In the Month *March* in the firſt Column, find the Day of the Month; over againſt which, under Leap Year, ſtands ♈ 47, which ſhews the Suns place to be in 47 min. of *Aries*; and in the next Column, under Leap Year, ſtands Nor. 18. which ſhews the Declination to be 18 min. Northerly, which was required.

Although it is commmon to take the Declination as it is in the Kalendar, yet if the Difference of Longitude be conſiderable from *London*, it is requiſite the Declination ſhould be corrected, becauſe in the Kalendar it is calculated to the Meridian of *London*, for which end the *Table of Variation of the Suns Declination to every* 15 *Degrees of Longitude from the Meridian of London*, immediately following the Kalendar is added; the Uſe and Explanation whereof follows.

The Explanation of the Table of Variation of the Suns Declination to every 15 *degrees of Longitude*, &c.

In the firſt Column is the Diurnal Variation, which is found by ſubtracting the Declination for the given day of the Month from the Declination for the day following; or contrarily this from that, that is, the leſſer from the greater, and the Difference is the Diurnal Variation. In the head of the other Columns, are the Degrees of Longitude from *London*, either Eaſterly or Weſterly; and in thoſe Columns, under the reſpective Degrees of Longitnde, are the minutes of Declination anſwerable to the Diurnal Variation. As ſuppoſe the Diurnal Variation were 10 minutes, and the Difference of Longitnde 90 degrees: againſt 10 in the firſt Column, and under 90 degrees at the head of the Table, ſtands 2 minutes, which anſwers thereto, and is to be uſed as follows.

The Use of the Table of Variation of the Suns Declination, &c.

The Rule.

First, If the Difference of Longitude be Westerly, and the Declination increasing, the Variation found in this Table, must be added to the Declination found in the Kalendar; but if the Declination be decreasing, it must be subtracted therefrom.

Secondly, If the Difference of Longitude be Easterly, and the Declination increasing, the Variation aforesaid must be subtracted; but the Declination decreasing, it must be added.

Example 2.

April the 10*th* 1678, being at Sea, the Difference of Longitude from the Meridian of *London* being 90 degrees Westerly, I find the Declination in the Kalendar to be 11 deg. 44 min. North, and the 11*th* day, the Declination is 12 deg. 05 min. therefore subtracting the lesser Declination from the greater, the Remainder is 21 min. which is the daily increase; then in this Table under 90 deg. and over against 21 stands 5 min. which (because the Difference of Longitude is Westerly, and the Declination increasing) must be added to 41 deg. 44 min. before found, which makes the true Declination 11 deg. 49 min. North.

If the Difference of Longitude in this case had been Easterly, the 5 min. found in the Table must have been subtracted.

It is easily discerned whether the Declination increase or decrease, by observing whether the Declination for the day following be greater or lesser; for if it be greater, then it increases; but if less, then it decreases.

Example 2.

January the 10*th* 1678, being at Sea, the Difference of Longitude from *London*, being 120 deg. Westerly, I find the Declination in the Kalendar to be 20 deg. 00 min. South, and the 11*th* day it is 19 deg. 46 min. therefore subtracting the lesser from the greater, the Difference is 14 min. which is the daily decrease; then in this Table under 120 deg. and against 14 stands 5 min. which (because the Difference

rence of Longitude is weſterly, and the Declination decreaſing) muſt be ſubtracted, which makes the true Declination 19 deg. 55 min. South. If the Difference of Longitude had been Eaſterly, the 5 minutes muſt have been added.

The Uſe of the Suns Declination to find the Latitude.

The Declination of the Sun is moſtly uſed at Sea, with the Complement of the Suns Meridian Altitude, taken by the Quadrant or Foreſtaff, to find the Latitude of the Place, for which take the following Directions.

1. If the Sun comes to the Meridian in the South, and the Declination be North, then the Declination added to the Complement of the Altitude, is the Latitude Northerly.

Example.

Suppoſe being at Sea the 10*th* of *April*, 1674. the Declination is found by the Table to be 11 deg. 44 min. North, the Sun comes to the Meridian in the South, the Complement of the Altitude got by Obſervation, is 23 deg. 10 min. What is the Latitnde?

	°	′
Complement of the Altitude is ——	23	10
Declination North added ———	11	44
The Latitude North ———	34	54

2. If the Sun comes to the Meridian in the North, and hath North Declination, then ſubtract the Complement of the Altitude from the Declination, the Remainder is the Latitude North. But if the Complement of the Altitude exceed the Declination, ſubtract the Declination therefrom, and the Remainder is the Latitude Southerly.

Example 1.

Suppoſe being at Sea, *May* 10*th* 1674. the Declination being 20 deg. 8 min. North, the Sun comes to the Meridian in the North, the Complement of the Altitude by Obſervation is 17 deg. 23 min. What is the Latitude?

	°	′	
Declination North is	20	08	
Compl. Alt. subtracted	17	23	
The Latitude is	02	45	North.

Example 2.

Suppose being at Sea *June* the 10*th* 1675. the Declination by the Table is 23 deg. 30 min. North, the Complement of the Altitude by Observation is 33 deg. 10 min. the Sun comes to the Meridian in the North : What is the Latitude ?

	°	′	
Compl. Alt. is	33	10	
Declinat. North subtracted	23	30	
Latitude is	09	40	South.

3. If the Sun comes to the Meridian in the North, and have South Declination, the Declination added to the Complement of the Altitude is the Latitude South.

Example.

Suppose being at Sea *January* 10*th* 1674. the Sun comes to the Meridian in the North, the Complement of the Altitude is 22 deg. 10 min. the Declination 20 deg. South, What is the Latitude ?

	°	′
Complement of the Altitude is	22	10
Declination South added	20	00
The Latitude South	42	10

4. If the Sun comes to the Meridian in the South, and have South Declination, subtract the Complement of the Altitude from the Declination, the Remainder is the Latitude South. But if the Comple-

ment

ment of the Altitude exceed the Declination, ſubtract the Declination therefrom, the Remainder is the Latitude North.

Example 1.

Suppoſe being at Sea *January* the firſt 1674. the Sun coming to the Meridian in the South, the Complement of the Altitude is 10 deg. 36 min. the Declination 21 deg. 44 min. South: What is the Latitude?

	°	′
Declination South	21	44
Compl. Alt. ſubtracted	10	36
Latitude South	11	08

Example 2.

Suppoſe being at Sea *February* the 10*th* 1674. the Sun coming to the Meridian in the South, the Complement of the Altitude is 25 deg. 20 min. the Declination 10 deg. 41 min. South: What is the Latitude?

	°	′
Compl. Alt. is	25	20
Declination South ſubtracted	10	41
Latitude North	14	39

5. If the Sun be in the Zenith, (that is right over head) if it have either North or South Declination, the Declination is the Latitude Northerly or Southerly.

6. If the Sun have no Declination, the Complement of the Altitude is the Latitude, which is Northerly or Southerly, according as the Sun is to the North or South.

A Table of the Suns Right Ascen.

Days.	January ☉ Right Ascen.		Febr. ☉ Right Ascen.		March. ☉ Right Ascen.		April. ☉ Right Ascen.		May. ☉ Right Ascen.		June. ☉ Right Ascen.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	19	35	21	42	23	28	01	21	03	14	05	19
2	19	39	21	46	23	32	01	25	03	18	05	23
3	19	43	21	50	23	36	01	29	03	22	05	27
4	19	47	21	54	23	39	01	33	03	26	05	31
5	19	51	21	58	23	43	01	36	03	30	05	36
6	19	56	22	02	23	46	01	40	03	34	05	40
7	20	00	22	06	23	50	01	44	03	38	05	44
8	20	04	22	10	23	53	01	47	03	42	05	48
9	20	09	22	14	23	57	01	51	03	46	05	52
10	20	13	22	17	00	01	01	54	03	50	05	56
11	20	17	22	21	00	05	01	58	03	54	06	00
12	20	22	22	25	00	08	02	02	03	58	06	04
13	20	26	22	29	00	12	02	06	04	02	06	08
14	20	30	22	33	00	15	02	10	04	06	06	12
15	20	34	22	36	00	19	02	13	04	10	06	17
16	20	38	22	40	00	23	02	17	04	14	06	21
17	20	42	22	44	00	26	02	21	04	18	06	25
18	20	46	22	48	00	30	02	25	04	22	06	29
19	20	50	22	52	00	33	02	29	04	26	06	33
20	20	54	22	55	00	37	02	32	04	30	06	38
21	20	58	22	59	00	41	02	36	04	34	06	42
22	21	03	23	03	00	44	02	40	04	38	06	46
23	21	07	23	06	00	48	02	44	04	42	06	50
24	21	11	23	10	00	52	02	48	04	46	06	54
25	21	15	23	13	00	55	02	51	4	50	06	58
26	21	19	23	17	00	59	02	55	04	54	07	02
27	21	23	23	21	01	03	02	59	04	58	07	06
28	21	27	23	25	01	06	03	03	05	02	07	10
29	21	31			01	10	03	07	05	06	07	14
30	21	35			01	14	03	10	05	11	07	19
31	21	38			01	17			5	15		

Days.	July. ☉ Right Ascen.		August. ☉ Right Ascen.		Septem. ☉ Right Ascen.		Octob. ☉ Right Ascen.		Novem. ☉ Right Ascen.		Decemb. ☉ Right Ascen.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	07	23	09	25	11	19	13	08	15	07	17	15
2	07	27	09	29	11	23	13	12	15	11	17	20
3	07	31	09	33	11	26	13	15	15	15	17	25
4	07	35	09	37	11	30	13	19	15	19	17	29
5	07	39	09	40	11	33	13	22	15	23	17	34
6	07	43	09	44	11	37	13	26	15	27	17	38
7	07	47	09	48	11	41	13	30	15	31	17	42
8	07	51	09	51	11	44	13	34	15	36	17	47
9	07	55	09	55	11	48	13	38	15	40	17	51
10	07	59	09	58	11	51	13	41	15	45	17	56
11	08	03	10	02	11	55	13	45	15	49	18	00
12	08	07	10	06	11	59	13	49	15	53	18	05
13	08	11	10	10	12	02	13	53	15	58	18	09
14	08	15	10	14	12	06	13	57	16	02	18	14
15	08	19	10	17	12	09	14	00	16	07	18	19
16	08	23	10	21	12	13	14	04	16	11	18	24
17	08	27	10	25	12	17	14	08	16	15	18	28
18	08	31	10	28	12	20	14	12	16	19	18	33
19	08	35	10	32	12	24	14	16	16	23	18	37
20	08	39	10	35	12	27	14	20	16	28	18	41
21	08	43	10	39	12	31	14	24	16	32	18	45
22	08	47	10	43	12	35	14	28	16	36	18	49
23	08	51	10	46	12	38	14	32	16	40	18	54
24	08	55	10	50	12	42	14	36	16	44	18	58
25	08	58	10	53	12	45	14	39	16	49	19	03
26	09	02	10	57	12	49	14	43	16	53	19	07
27	09	06	11	01	12	53	14	47	16	57	19	11
28	09	10	11	04	12	57	14	51	17	02	19	16
29	09	14	11	08	13	01	14	55	17	06	19	20
30	09	17	11	11	13	04	14	59	17	11	19	25
31	09	21	11	15			15	03			19	30

A Table of Right Aſcenſion and Declination of ſome of the moſt notable Fixed Stars.

Stars Names.	Magnit.	Right Aſcenſ. H.	M.	Declination. D.	M.	N. or S.
POle Star	02	00	32	87	33	N
The upper of the two foremoſt of the Square in the Little Bear	02	14	51	75	36	N
The upper of the two foremoſt of the Square in the Great Bear	02	10	43	63	32	N
The lower of the two foremoſt of the Square in the Great Bear	02	10	41	58	08	N
The lower of the two latter of the Square of the Great Bear	02	11	36	55	33	N
The upper of the two latter in the Square of the Great Bear	02	11	59	58	51	N
Laſt but two in the Great Bears Tail	02	12	40	57	47	N
Laſt but one in the ſame	02	13	10	56	41	N
Laſt in the ſame	02	13	34	51	00	N
The Dragons Tail	02	13	59	65	56	N
Arcturus	01	14	01	20	58	N
Brighteſt in the Crown	02	15	21	27	51	N
Brighteſt in the Harp	01	18	26	38	30	N
Swans Tail	02	20	30	44	05	N
Perſeus Right Side	02	02	57	48	36	N
Goat, or Capella	01	04	52	45	37	N
Auriga's Right Shoulder	02	05	44	44	56	N
Brighteſt in the Serpents Neck	02	15	28	07	30	N
Brighteſt between the Eagles Shoulders	02	19	35	08	03	N
Firſt in Pegaſus Wing, or Marchab	02	22	48	13	28	N
Beginning of Pegaſus Leg	02	22	48	26	18	N
End of Pegaſus Wing	02	23	57	13	22	N
Andromeda's Head	02	23	52	27	18	N
Southermoſt in Andromeda's Girdle	02	00	51	33	55	N
Andromeda's Southermoſt Foot	02	01	44	40	44	N

A Table of Right Aſcenſion and Declination of ſome of the moſt notable Fixed Stars.

Stars Names.	Magnit.	Right Aſcen. H.	Right Aſcen. M.	Declination. D.	Declination. M.	N. or S.
The Bulls Eye, or Aldelbrand	01	04	17	15	48	N
End of the Bulls-Horn	02	05	06	28	21	N
Caſtor	02	07	14	32	33	N
Pollux	02	07	25	28	46	N
Bright foot of Gemini	02	06	19	16	38	N
Brighteſt in the Lions Neck	02	10	02	21	29	N
Lions Heart	01	09	51	13	33	N
Lions Tail	01	11	32	16	25	N
Virgins Spike	01	13	08	09	31	S
Southermoſt Scale of Libra	02	14	33	14	37	S
Northermoſt Scale of Libra	02	14	59	08	07	S
Scorpions Forehead	02	15	46	18	51	S
Scorpions Heart	01	16	10	25	37	S
Fomahant	01	22	39	31	17	S
Whales Jaw	02	02	45	02	48	N
Orions Right Shoulder	02	05	38	07	18	N
Orions Left Shoulder	02	05	08	06	01	N
Firſt in Oriens Belt	02	05	15	00	35	S
Middle of Orions Belt	02	05	20	01	26	S
Laſt in Orions Belt	02	05	24	02	09	S
Orions left Foot, or Regel	01	04	59	08	37	S
Mouth of the Great Dog, or Syrius	01	06	31	16	14	S
Right Forefoot of the Great Dog	02	06	09	17	49	S
Little Dogs Thigh	02	07	22	06	03	N
Hydra's Heart	01	09	12	07	15	S

The Explanation and Uſe of the Table of the Suns Right Aſcenſion; and of the Table of the Stars Right Aſcenſion and Declination.

IN the Table of the Suns Right Aſcenſion, the firſt Page contains the firſt ſix Months of the Year, the next Page the other ſix months. At the head of the Table are the months; in the firſt Column towards the left hand are the days of the month, and in the oppoſite Columns is the Right Aſcenſion in Hours and Minutes.

In the Table of the Stars Right Aſcenſion and Declination, there are five Columns; In the firſt, towards the Left-hand, are the names of the Stars, in the ſecond, the Stars Magnitude; in the third, their Right Aſcenſion in Hours and Minutes; in the fourth, their Declination in Degrees and Minutes; the laſt ſhews whether the Declination be North or South.

The Uſe of the Tables.

Firſt, To find the time of the Stars coming upon the Meridian.

The Rule.

Look the Right Aſcenſion of the Sun and Star; ſubtract the Right Aſcenſion of the Sun from the Right Aſcenſion of the Star; but if the Stars Right Aſcenſion be leſs than the Suns, add thereto 24 hours, and then ſubtract; the Remainder after Subtraction, is the time of the Stars coming upon the Meridian from Noon; but if the Remainder exceed 12 hours, ſubtract 12 hours therefrom, and then the Remainder is the time from Midnight.

Example 1.

Suppoſe the time that *Fomahant* comes upon the Meridian on the 10*th* of *October* 1675, were required.

I find in the Table the Stars Right Aſcenſion to be 22 hours 39 min. and the Suns to be 13 hours 41 min. which ſubtracted from the Stars Right Aſcenſion, leaves 8 hours 58 min. the time of the Stars coming upon the Meridian Afternoon.

Example 2.

Suppoſe the time that the *Whales Jaw* comes upon the Meridian on the 15*th* of *October* 1675 was required.

I find the Stars Right Aſcenſion to be 2 hours 45 min. the Suns 14 hours: Now becauſe the Suns Right Aſcenſion is more than the Stars, add

add to the Stars Right Aſcenſion 24 hours, which makes 26 hours 45 min. from which ſubtracting the Suns Right Aſcenſion, there remains 12 hours 45 min. from which ſubtracting 12 hours, there remains 45 min. which is the time of the Stars Southing after Midnight, which was required.

Secondly, The time being given, to find what Star will come to the Miridian about the ſaid time.

The Rule.

To the Suns Right Aſcenſion, add the time from Noon, at which the Stars coming to the Meridian is deſired, the ſum is the Right Aſcenſion of the Star that will come to the Meridian at that time; with which enter the Table of the Stars Right Aſcenſion and Declination, where look what Stars Right Aſcenſion agrees with the Right Aſcenſion before found, or neareſt thereto, and that is the Star ſought for.

Example.

Suppoſe *March* the 27*th*, I deſire to know what Star will come upon the Meridian at 4 hours after Midnight.

The Suns Right Aſcenſion is 1 hour 3 min. the time from Noon is 16 hours, which added to the Suns Right Aſcenſion, makes 17 hours 3 min. The neereſt in the Table, are the *Scorpions Heart*, whoſe Right Aſcenſion is 16 hours 10 min. and comes to the Meridian 53 min. before 4. And the *Brighteſt in the Harp*, whoſe Right Aſcenſion is 18 hours 26 min. and therefore comes to the Meridian 1 hour 23 min. after 4, or at 5 hours 23 min.

Directions for Obſervation of the Stars, to find the Latitude of the Place.

Having before ſhewn how to find the time of a Stars coming to the Meridian, I ſhall now ſhew how thoſe Stars are to be obſerved.

Note, Firſt in North Latitude, thoſe Stars whoſe North Declination exceeds the Complement of the Latitude, may be obſerved under the Pole.

Secondly *Note*, In South Latitude, thoſe Stars whoſe Declination South is more than the Complement of the Latitude, may be obſerved under the Pole.

To make this plain, I ſhall give ſome Examples.

Rule 1.

If the Star comes to the Meridian in the South, and have North Declination, the Complement of the Altitude (got by Obſervation) added to the Declination of the Star (found in the Table of the Stars Right Aſcenſion and Declination) gives the Latitude North.

Example.

On the 10*th* of *June* 1675, being at Sea, I find by the foregoing Directions, that the *bright Star between the Eagles ſhoulders*, comes to the Meridian in the South at 1 hour 39 min. after Midnight, the Meridional Altitude whereof by Obſervation is 63 deg. which ſubtracted from 90 deg. there remains 27 deg. the Complement of the Altitude; to which adding 8 deg. 3 min. the Declination of the Star North gives 35 deg. 3 min. the Latitude of the place North, which was required.

Rule 2.

If a Star come to the Meridian in the South, and have South Declination, ſubtract the Declination from the Complement of the Altitude, and the Remainder is the Latitude North; But if the Declination exceed the Complement of the Altitude, ſubtract the Complement of the Altitude therefrom, and the Remainder is the Latitude South.

Example 1.

Suppoſe on the 10*th* of *July* 1675, being at Sea, the Star *Fomahant* coming to the Meridian in the South, at 2 hours 40 min. after Midnight, the Meridional Altitude is 35 deg. 50 min, the Complement whereof is 54 deg. 45 min. the Stars Declination is 31 deg. 17 min. South; which ſubtracted from the Complement of the Altitude, leaves 23 deg. 28 min. the Latitude North.

Example 2.

Suppoſe on the 20*th* of *June* 1675. being at Sea, the *Scorpions Heart* comes to the Meridian in the South at 9 hours 32 min. at Night, the Complement of the Altitude is 5 deg. 27 min. the Declination 25 deg. 37 min. South; from which ſubtracting the Complement of the Altitude, there remains 20 deg. 10 min. which is the Latitude South.

Rule 3.

If a Star come to the Meridian in the North, and have North Declination, ſubtract the Declination from the Complement of the Altitude, the Remainder is the Latitude South. But if the Declination exceed the Complement of the Altitude, ſubtract the Complement of the Altitude therefrom, the Remainder is the Latitude North.

Example

Example 1.

On the 11*th* of *June* 1675, the *Brighteſt in the Harp* comes to the Meridian in the North at 26 min. after Midnight, the Complement of the Altitude is 79 deg. from which ſubtracting the Declination, which is 38 deg. 30 min. North, there remains 40 deg. 30 min. which is the Latitude South.

Example 2.

On the 8*th* of *September* 1675, *Andromeda's Head* comes to the Meridian in the North at 8 min. after Midnight; the Complement of the Altitude is 7 deg. 10 min. which ſubtracted from the Declination 27 deg. 18 min. gives 20 deg. 8 min. which is the Latitude North.

Rule 4.

If a Star come to the Meridian in the North, and have South Declination, the Complement of the Altitude added to the Declination gives the Latitude South.

Example.

On the 12*th* of *December*, *Syrius* (or the *Great Dogs Mouth*) comes to the Meridian in the North at 11 hours 26 min. at Night, the Complement of the Altitude is 30 deg. to which adding 16 deg. 14 min. the Declination South gives 46 deg. 14 min. the Latitude South.

Rule 5.

If a Star come to the Meridian under the Pole, then add the Complement of the Declination to the Meridian Altitude, and the Sum is the Latitude either North or South, according to the Stars Declination.

Example.

On the 10*th* of *March* 1675, the Pole Star comes to the Meridian under the Pole at 31 min. after Midnight, the Meridian Altitude 44 deg. 30 min. the Complement of the Declination 2 deg. 27 min. which added together gives 46 deg. 57 min. which is the Latitude North.

Rule 6.

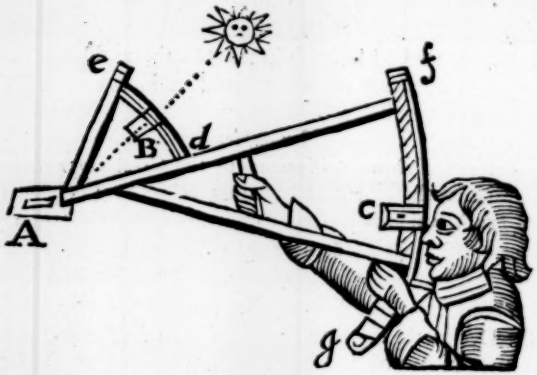
If the Star be in the *Zenith*, the Declination is the Latitude either North or South, according to the Declination of the Star.

Rule 7.

If the Star have no Declination, the Complement of the Meridian Altitude, is the Latitude of the place either North or South, according as the Star is to the Northward or Southward.

The next thing, becauſe of its pertinency in this place, is the Uſe of the *Quadrant*, *Foreſtaff*, and *Nocturnal*.

The Figure *of the* Sea-Quadrant.



The Deſcription and Uſe of the Sea-Quadrant.

THis Inſtrument conſiſts of three Vanes and two Arches; the Horizon Vane, which in obſerving, reſpects the Horizon as at A. The Shadow-Vane, ſo called, becauſe of its giving the ſhadow upon the Horizon-Vane, in time of Obſervation, as at B. Laſtly, The Sight-Vane, which in time of Obſervation is placed at the Eye, through which the Shadow and Horizon are ſeen, as at C. The leſſer of the Arches marked with *d*, *e*, is called the Sixty Arch, becauſe it contains 60 degrees. In time of Obſervation, the Shadow-Vane is placed upon this Arch always to an even degree, it is numbred from the upper end at *d*, downward to *e*, with 5, 10, 15, 20, &c.

The bigger Arch marked with *f*, *g*, is called the Thirty Arch, becauſe it contains 30 degrees; it is divided into degrees and minutes.

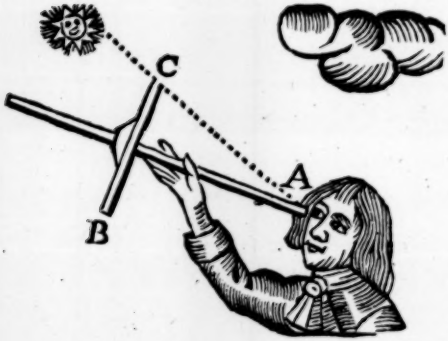
The

The Uſe of the Quadrant.

The Uſe of this Inſtrument, is to take the Suns Meridian Altitude, which is done in the manner following.

Put the Horizon-Vane upon the end of the Quadrant at A, the Shadow Vane upon the Sixty (or leſſer) Arch, to a number of degrees leſs than the Complement of the Altitude by 15 or 20 degrees; and the Sight Vane upon the Thirty Arch. The Vanes being thus fixed upon the *Quadrant*, the back being turned towards the Sun, and the Sight-Vane placed to the Eye, look through the ſaid Sight-Vane, and cauſe the Shadow of the upper edge of the Shadow Vane, to fall upon the upper part of the ſlit in the Horizon-Vane, where uſually (for perſpicuity-ſake) there is drawn a black Line; and if at the ſame time the Horizon appear through the ſaid ſlit in the Horizon-Vane, that is the Suns preſent Altitude; but if the Sea appear inſtead of the Horizon, then ſlide the Sight-Vane lower towards G; but if the Skie appear inſtead of the Horizon, then ſlide the Sight-Vane a little higher, until the Horizon appear through the Horizon-Vane. But to obtain the Meridian Altitude, (which is the greateſt Altitude the Sun will have that day, and is the thing uſed to find the Latitude) continue obſerving, and as the Sun riſes, the Sea will appear through the Horizon-Vane, then muſt the Sight-Vane be removed lower, and thus continue obſerving as often as may be convenient, till the Sun is at the higheſt which is the Meridian Altitude. When the Sun begins to fall, the Skie will appear inſtead of the Horizon, and then it is time to give over obſerving for that day. Having thus done, add the degrees upon the Sixty Arch, to the degrees and minutes upon the Thirty Arch, and the Sum is the Complement of the Meridian Altitude; the Uſe of which, for finding the Latitude, is ſufficiently ſhown in the preceding Rules.

The Figure *of the* Foreſtaff.



The Deſcription and Uſe of the Foreſtaff.

THis Inſtrument conſiſts of a Staff and four Croſſes; the firſt and ſhorteſt is called the Ten Croſs, and it belongs to that ſide of the Staff, which is numbred from about 3 degrees, to 10 degrees. Sometime the Thirty Croſs is ſo made, as that the breadth thereof ſerves inſtead of this Ten Croſs.

The ſecond Croſs is called the Thirty Croſs, and belongs to that ſide of the Staff which is numbered from about 10 degrees to 30.

The third Croſs is called the Sixty Croſs, and belongs to that ſide of the Staff which is numbered from about 20 to 60 degrees.

The fourth and laſt Croſs is called the Ninety Croſs, and belongs to that ſide of the Staff which is numbered from about 30 to 90 degrees.

Sometimes this Staff is likewiſe numbered with the Complement to 90 degrees, (*viz.*) at 10 ſtands 80, at 20 ſtands 70, at 30 ſtands 60, and ſo of the reſt.

The

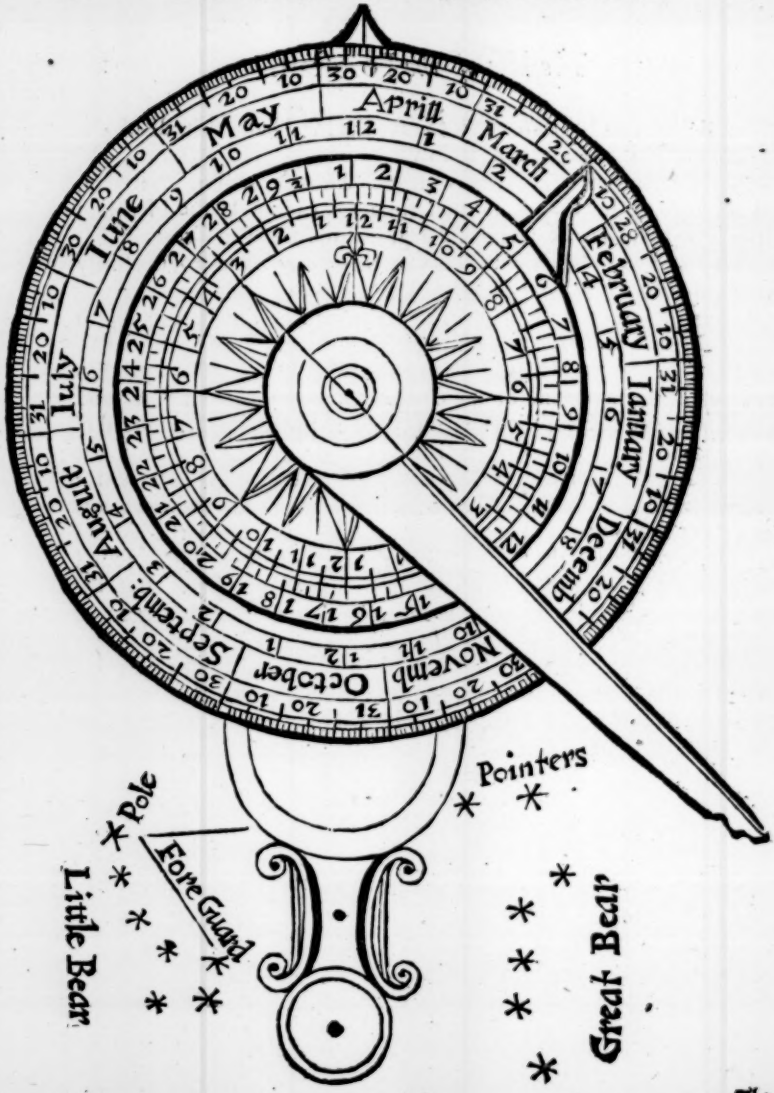
The Uſe of the Foreſtaff.

The Uſe of this Inſtrument, is to take the Meridian Altitude of the Sun or Stars, which is done as follows.

Firſt, Conſider what the Suns greateſt Altitude will be that day, and accordingly uſe the Croſs moſt ſuitable, (*viz.*) If the Meridian Altitude be judged to be under 10 degrees, uſe the Ten Croſs; if between 10 and 30, the Thirty Croſs; if between 30 and 60, the Sixty Croſs; if between 60 and 90, the Ninety Croſs.

Having put on the Croſs, place the flat end of the Staff as A, to the out-ſide of the Eye, as near as may be, without hindring the ſight; thus the Face being towards the Sun or Star, hold the Croſs upright; then look at the upper end of the Croſs at C, for the Sun or Star, and at the lower end at B for the Horizon; and if the Sea appear inſtead of the Horizon, remove the Croſs a little further from the Eye; but if the Skie appear inſtead of the Horizon, remove the Croſs a little nearer the Eye, until the Sun or Star appear at the upper end, and the Horizon at the lower end; which when they do, then upon the ſide of the Staff belonging to the Croſs uſed in the Obſervation, will be found the degrees and minutes of the Altitude of the Sun or Star. But the greateſt Altitude being that which is required, Obſervation muſt be continued as frequently as Judgment ſhall direct, until the Sun or Star be at the higheſt; and as the Sun or Star riſes, the Skie will appear inſtead of the Horizon; but when the Sun or *Star* is paſt the Meridian, and begins to fall, the *Sea* will appear inſtead of the Horizon, and then is the Obſervation finiſhed; and upon the ſight of the Staff, proper to the Croſs uſed, are found the degrees and minutes of the *Suns* Meridian Altitude; which ſubtracted from 90 degrees, gives the Complement of the Altitude; or it may be taken off the Staff at once, (the Staff being numbered with the Complement, as is ſhewed before) with which to proceed in finding the Latitude of the Place, obſerve the Rules and Directions foregoing.

The Figure of the Nocturnal.



The

The Description and Use of the Nocturnal.

IT consists of three parts. The first and unmoveable part, on which is the handle, by which to hold it in time of Observation; upon the foreside of which, in the outermost Circle, are the days of the Month, and upon the innermost are set off the 24 hours; upon the back-side are the 32 Points of the Compass.

There are two sorts of Nocturnals, the one made for the Great Bear, the other for the little Bear; Those that are made for the Great Bear have *February* at the top, but those that are made for the Little Bear have *April*.

The second, or middle part, contains two Circles and a small Index; the outermost Circle is divided into the 29 days and ½ of the Moons Age, the innermost into 24 Hours; the Index is to be set to the Day of the Month at pleasure.

The third, and uppermost part, is a long Index; The edge of which (that respects the Center) must be turned to the Guards in time of Observation.

The Use of the Nocturnal.

To find the hour of the Night, and upon what Point of the Compass the Guards are.

To do this, First set the Index of the middle part of the day of the Month; then hold the Instrument upright, which may be discerned by the Tip on the top of the Nocturnal; then look through the Hole in the middle of the Nocturnal for the North Star; which having found, turn the edge of the long Index to the Guards, (for which the Nocturnal was made) either of the Little or Great Bear, then shall the edge of the Index (upon the innermost Circle of the middle part) give the Hour of the Night; and at the same time on the back-side of the Nocturnal, is the Point of the Compass on which the Guards are.

But if the Practitioner intend to be more exact and certain in the time of the Night, let him take the Altitude of some known Star, and proceed according to the Directions given in the *Tenth Astronomical Problem* following.

To find the Moons Southing, and time of Full Sea, by the Nocturnal.

To do this, It is but looking upon the middle piece of the Nocturnal, and in the outermoſt Circle find the Moons Age, and oppoſite to it in the innermoſt Circle of the ſame piece ſtands the Southing.

Example.

Suppoſe the Moon 25 days old, and the time of her Southing required.

Look for 25 the Moons Age in the outermoſt Circle, oppoſite to which in the innermoſt Circle ſtands 8, which is the Moons Southing at 25 days old required.

Note, That always between the Change and Full, the Moon comes to South in the evening, but after the Full in the Morning.

Thus having found the Moons Southing, add thereto the time of Flowing upon the Full and Change Days at any place, and that gives the time of Full Sea when required. But this hath been ſufficiently ſhewed in another place, therefore needs no Example.

The Uſe of the following Table of the Declination of the North Star.

THe Uſe of the Table is this; Having taken the Altitude of the Pole Star, then obſerve with the Nocturnal, upon what Point of the Compaſs the Guards are; oppoſite to which in this Table ſtands the Declination, (ſo called); which if the Star be below the Pole, is to be added to the Altitude; but if the Star be above the Pole, to be ſubtracted therefrom, to find the Latitude of the place.

But the more exact way to find the Latitude, is by thoſe other directions for the Stars before given.

Here followeth a Table for the Declination of the North Star, upon every point of the Compass the guards are upon, fitted for both sorts of Nocturnals.

If the former of the Guards be descending from the South, or upper part of the Merid.	If the former of the Guards be ascending from the North, or lower part of the Meridian.	Points of the Compass.	For the guard of the Little Bear. D. M.	
		North.	2 09	The North-Star is above the Pole.
		N by E	1 52	
		N N E	1 29	
		N E by N	1 02	
		North East	0 35	
		N E by E	0 06	
		E North E	0 22	
		E by N	0 52	
		East.	1 18	
		E by S	1 41	The North Star is under the Pole.
		E S E	2 01	
		S E by E	2 16	
		South East	2 25	
		S E by S	2 30	
		S S E	2 29	
		S by E	2 22	
		South.	2 11	
		S by W	1 55	
		S S W	1 34	
		S W by S	1 10	
		South West	0 43	
		S W by W	0 14	
		W S W	0 15	
		W by S	0 44	
		West.	1 11	The North-Star above the Pole.
		W by N	1 36	
		W N W	1 58	
		N W by W	2 14	
		North West	2 25	
		N W by N	2 30	
		N N W	2 29	
		N by W	2 22	

For the guards of the Gr. Bear, or aftermost Wheels in *Charles's Wain*, called the two Pointers.			
If the two Pointers be descending from the South, or upper part of the Meridian	If the after-Wheels, or two Pointers be ascend. from the North or lower part of the Merid.	D. M.	
		2 20	Above the Pole.
		2 30	
		2 35	
		2 33	
		2 26	
		2 13	
		1 55	
		1 33	
		1 07	
		0 38	
		0 08	The North Star is under the Pole.
		0 22	
		0 52	
		1 20	
		1 44	
		2 04	
		2 20	
		2 30	
		2 29	
		2 28	
		2 26	
		2 13	
		1 55	
		1 33	
		1 07	
		0 38	
		0 08	
0	0	0 22	Above the Pole.
0	0	0 52	
1	1	1 20	
1	1	1 44	
2	2	2 04	

A Table of the Latitude and Longitude of the principal Ports, Harbours, Headlands and Islands in the World: Beginning from the Meridian of Pico Teneriff. *Newly Corrected acording to best Observations.*

	Places Names.	Lat. D.	Lat. M.		Long. D.	Long. M
Coast of *Greenland* and *Nova Zembla.*	*Hacluits Head-land,*	79	35	N	32	50
	Fair Foreland	79	30	N	30	45
	Point Look-out	77	30	N	38	20
	Hope Island	76	58	N	46	45
	Cherry Island	75	19	N	45	30
	Ice Point	77	10	N	86	30
	Cape Nassaw	76	3	N	85	00
	Admiralties Island	75	10	N	83	20
	Fretum Burrough	66	30	N	83	30
Coast of *Lapland* and *Norway.*	*Cape Candenose*	68	40	N	63	09
	Burgen	61	00	N	26	10
	Archangel	65	30	N	60	20
	Wardshays	70	50	N	48	10
	Kildivia Isle	69	50	N	51	00
	North Cape	71	38	N	42	30
	Naze of Norway	58	11	N	26	30
Coast in the *Sound.*	*Gottenburg*	58	10	N	31	20
	Danzick	54	23	N	40	00
	Stockholm	59	20	N	39	05
	Gotland Isle	58	20	N	39	15
	Copen-Haven	55	43	N	33	48
	Elsenore	56	40	N	33	50
	The Scaw	57	37	N	20	30

Hamburg

	Places Names.	Latitude. D.	M.		Longit. D.	M.
Coast of *Holland* and *Flanders.*	*Hamburg*	53	50	N	29	20
	The Texel	53	03	N	26	00
	Amsterdam	52	21	N	25	50
	Roterdam	51	59	N	25	40
	The Brill	51	55	N	24	57
	Calice	51	00	N	23	05
Islands near the Coast of *Scotland.*	*Kilda Island*	58	02	N	12	50
	Lewis Island	58	30	N	13	30
	Fair Islands	61	43	N	14	50
	Shotland	60	22	N	18	30
	Isles of Orkney	58	50	N	17	20
	Buss Island	59	10	N	02	20
Coast of *Island.*	*Merchants Foreland*	63	36	N	02	10
	Langeness	67	20	N	06	10
	Snow Hill	65	40	N	350	00
Coast of *England* and *Scotland.*	*London*	51	32	N	21	00
	Buchaness	58	04	N	18	45
	Tinmouth	55	12	N	20	10
	Flambrough Head	54	10	N	21	08
	The Sporn	53	45	N	21	20
	Wintertonness	52	54	N	22	45
	Orfordness	52	24	N	22	40
	North Foreland	51	36	N	22	35
	South Foreland	51	13	N	22	30
	Dover	51	12	N	22	29
	Dungeness	51	00	N	22	08
	Isle of Wight	50	37	N	19	30
	Portland	50	28	N	18	25
	The Start	50	10	N	16	55
	The Lizard	50	10	N	15	00
	Isles of Scilly	50	12	N	14	10

	Places Names.	Latitude. D.	M.		Longit. D.	M.
Coast of Eng. and Scotland	*Londeys Isle*	51	18	N	16	15
	Davids Head	52	05	N	15	35
	Bristol	51	28	N	18	15
Coast in the *Irish Sea.*	*Holy Head*	53	33	N	16	25
	Isle of Man	54	25	N	16	40
	Faire Foreland	55	15	N	14	30
	Black Rock	52	08	N	14	25
	Sline Head	53	02	N	12	00
	Blasques	52	03	N	11	25
	Cape Clear	51	03	N	12	00
	Old Head	51	28	N	12	30
	Dublin	53	20	N	14	30
Coast of *France, Spain,* and *Portugal.*	*Seyn Head*	49	50	N	21	20
	Cape Hage	49	55	N	18	35
	Garnsey	49	35	N	18	05
	Jersey	49	30	N	18	30
	Ushant	48	35	N	15	00
	Brest	48	30	N	15	10
	Bilboa	43	34	N	16	20
	Bourdeaux	45	30	N	19	30
	Cape Ortegal	44	04	N	11	40
	Cape Finisterre	43	06	N	90	30
	Lisbon	38	40	N	10	05
	Cape Vincent	37	00	N	09	50
	Straits of Gibralter	35	50	N	13	15
Sea Coast in the *Straits.*	*Cape de Gata*	36	35	N	19	40
	Cape Martin	38	34	N	22	20
	Marsilles	43	20	N	26	40
	Genoa	44	27	N	31	00
	Rome	41	54	N	34	20
	Cape Sparteventura	37	34	N	37	15

	Places Names.	Latitude. D.	M.		Longit. D.	M.
Sea Coasts in the Straits.	Cape Maria	39	40	N	39	30
	Naples	41	05	N	36	12
	Angello	41	19	N	31	40
	Legorn	43	18	N	31	30
	Venice	45	20	N	35	11
	Cape Mapatan	36	00	N	46	40
	Scanderoon	36	56	N	49	00
	Cape Rusato	30	38	N	45	10
	Tunis	35	18	N	30	25
	Cape Tres forcas	35	28	N	19	00
	Tangier	35	25	N	13	20
Islands in the Straits.	Alboran	37	53	N	19	15
	Formentara	38	45	N	24	40
	Ivica	39	06	N	23	00
	Majorca	39	39	N	24	30
	Minorca	39	56	N	25	50
	Cape Napoli in Sardinia	39	10	N	30	30
	Cape Corso in Corsica	42	52	N	31	20
	Limpadosa	55	59	N	33	50
	Malta	35	45	N	35	40
	Cape Passaro in Sicilia	36	33	N	36	20
	Messina,	37	20	N	35	55
	Corfu	38	54	N	42	50
	Cephalonia	37	57	N	43	30
	Zant	36	42	N	43	40
	Cape Spudea in Candia	34	50	N	47	05
	Candia City	34	40	N	46	50
	Rhodes	34	45	N	50	50
	West end of Cyprus	33	27	N	54	10
	East end of Cyprus	33	53	N	57	35
	Smirna	38	40	N	50	10
	Constantinople	42	50	N	53	30
	Salonichi	40	30	N	45	10
	Alexandria	30	28	N	55	20
	Lepanto	37	30	N	44	30

	Places Names.	Latiude. D.	M.		Longit. D.	M.
Coast of *Barbary* and *Guiny*.	*Cape Spartel*	35	41	N	012	20
	Cape Cantin,	32	30	N	008	00
	Cape de Geere,	29	56	N	006	38
	Cape de Non,	28	30	N	005	49
	Cape Bojador,	27	09	N	001	53
	Cape Blanco,	20	30	N	359	11
	Cape Verde,	14	26	N	359	00
	River Gambia,	13	00	N	000	41
	Cape Roco,	11	41	N	000	30
	Cape Monte,	05	40	N	004	00
	Cape Palmas,	04	07	N	009	50
	Cape Tres Puntas,	04	15	N	015	25
	Cape Corse,	04	20	N	016	30
	Cape Formosa,	04	20	N	024	25
	Thomas Island,	00	10	N	026	05
	Cape Negro,	16	00	S	029	55
	Cape Bona Esperance,	34	30	S	037	15
Western Islands.	*Flores*,	39	39	N	347	37
	Fyal,	38	55	N	349	30
	Georges,	39	10	N	352	30
	Tercera,	39	56	N	351	10
	The East end of St. Michaels,	37	54	N	353	00
	St. Maries,	37	15	N	353	10
	Gratiosa	39	40	N	349	35
Canary Islands.	*Ferro*,	27	38	N	357	55
	Palma,	28	50	N	357	55
	Gomera,	28	08	N	358	25
	Teneriff,	28	42	N	000	00
	Madera,	32	25	N	001	55
	Canaria,	28	00	N	000	55
	Forteventura,	28	06	N	003	41
	Lancerotta,	28	30	N	004	35

	Places Names.	Latitude. D.	M.		Longit. D.	M.
Cape de Verde Islands	Maio	14	49	N	353	17
	Fogo	14	28	N	351	41
	Fago	14	40	N	352	35
	Sall	16	50	N	353	44
	Anabona	01	35	S	023	50
	Aſſenſion	08	00	S	006	40
	Hellena	16	00	S	015	25
	Hellena Nova	16	40	S	022	05
Coaſt in the East India.	Cape Anguilloa	34	58	S	38	50
	Cape Corientes	23	36	S	54	30
	Cape Sebaſtian	22	40	S	56	25
	Sophala Iſles	21	00	S	56	20
	Quilloa	08	55	S	61	30
	Cape Falco	08	30	S	61	40
	Pemba Iſland	05	38	S	61	32
	Magadoxa	02	35	N	64	43
	Socatora Iſle	12	36	N	77	40
	Cape Dorfui	10	20	N	74	50
	Cape de Gardaſſin	12	15	N	74	55
	Cape Aden	13	14	N	71	00
	Cape Raſolgate	22	26	N	83	50
	Gulf de Perſia	20	58	N	96	23
	Cape de Faſques	25	30	N	83	05
	Cape de Guadel	24	55	N	88	05
	Diul	24	32	N	92	25
	Cape Jaquack	22	40	N	92	55
	Surrat	21	10	N	97	30
	Bombay Iſle	19	18	N	97	00
	Goa	15	40	N	97	55
	Cape Comorin	07	28	N	100	35
	River Bengale	21	45	N	111	43
	Jambes	01	05	N	123	40
	Siam	14	28	N	123	50
	Fort St. George	13	30	N	102	30
	Balaſor	21	50	N	109	10

	Places Names.	Latitude. D.	M.		Long D.	M
Coast in the East-Indies	*Cape Liampo*,	26	10	N	149	30
	Nanguſaque	32	00	N	150	05
	Canton in China.	23	30	N	134	50
	Corea	35	40	N	146	00
Iſlands in the East-Indies.	St. *Maria* at the South end of *Madagaſcar*	25	30	S	64	30
	St. *Maria* at the North end of *Madagaſcar*	12	14	S	69	30
	Diego Roiza	19	10	S	80	25
	Mauritius	20	10	S	75	30
	Muſcaennrus	21	36	S	73	40
	Timor	10	21	S	144	05
	The Weſt end of Java	06	15	S	123	05
	The Eaſt end of Java	07	45	S	132	10
	Bantam in Java	06	46	S	125	40
	Java	07	10	S	135	20
	Cambava	08	16	S	136	43
	Sunda Straits	06	00	S	125	23
	Achem at the North-Weſt Point of *Sumatra*	05	55	N	116	05
	The South-Eaſt end of *Sumatra*	05	55	S	125	01
	Ceram and *Amboina*	04	10	S	145	31
	Macaſſer on the South end of *Celebes*	05	30	S	139	40
	Manado on the North end of *Celebes*	02	00	N	143	02
	The South end of *Gilolo*	01	35	S	146	42
	Niſſaw Iſle	00	00	N	118	15
	Tidore	00	36	N	144	05
	Saltadores	03	30	N	164	40
	Cape Aert on the Eaſt ſide of *Borneo*	03	00	N	134	31
	Ouro	01	45	N	115	02
	Mindano City and Iſle	05	46	N	144	09

	Places Names.	Latitude. D.	M.		Longit. D.	M.
Islands in the *East-Indies.*	*Batuba*	06	45	N	142	00
	Matan	08	40	N	163	20
	Cherega	09	35	N	162	55
	Jaffanapatan Cape of Cylon	10	10	N	104	45
	Tandaia	12	40	N	112	11
	Mindora	13	24	N	140	00
	Malabrigo	18	30	N	163	15
	Aynam	19	15	N	129	40
	Formosa	23	34	N	139	35
	Meaco in *Japan*	36	00	N	155	10
	Jado in Japan	35	40	N	159	50
	Tandoxima by *Japan*	31	10	N	148	53
	Goto	32	40	N	147	08
	Firando	33	15	N	150	00
	Straits of Zungaar	40	30	N	160	30
Coast of *America* in the South Sea.	*Cape Blanco*	42	04	N	234	40
	Port Drake	38	20	N	236	00
	Cape Barbara	36	25	N	243	00
	Cape St. Lucas	23	05	N	258	10
	Cape Corientes	20	23	N	265	30
	Cape Corientes	06	00	N	302	30
	Cape Blanco	03	46	S	304	50
	Ambrose Iſles	25	54	S	301	25
	Baldivia	40	00	S	304	15
	Caſtro	43	20	S	301	55
	Cape Victoria at the Weſt entrance of *Magellan*	52	50	S	298	20
	Cape Virginia at the Eaſt entrance of *Magellan*	52	00	S	307	30
	Port Julian	48	30	S	308	20
	Cape Horn	57	50	S	304	10

	Places Names.	Latitude. D.	M.		Longit. D.	M.
The Coast of the Main Continent of *America.*	*Strait Lemaire*	55	26	S	310	00
	Port Desire	47	50	S	309	50
	Cape Antonio	36	18	S	320	10
	Cape Maria	35	10	S	320	05
	Cape Frio	23	12	S	343	00
	Paroibo	04	30	S	348	00
	Cape Blanco	02	20	S	343	15
	North Cape de Guiana	01	51	N	332	31
	Suranam	06	00	N	328	30
	Cape de Vela	12	10	N	310	20
	Nombre de Dios	09	42	N	302	30
	Panama	09	10	N	302	00
	Cape Gratias a Dios	14	10	N	299	30
	Cape de Catoch	21	14	N	295	10
	La Vera Cruz	19	55	N	285	30
	Cape Florida,	24	30	N	299	30
	Afhly River	33	00	N	301	50
	Cape Fair	34	08	N	302	50
	Cape Henry,	37	06	N	305	50
	James Town	37	05	N	304	50
	Cape Hattaras	35	20	N	306	00
	Cape Charles,	37	22	N	306	00
	Plimouth in *New England*	42	00	N	315	30
	Cape Codd,	41	50	N	316	40
	Cape Ann,	42	15	N	316	00
	Isle of Sables	44	17	N	326	00
	Cape Brittain	45	24	N	327	00
	Cape Raze,	46	30	N	333	40
	Cape Bona Vista,	50	03	N	333	25
	Bell Isle,	52	09	N	330	30
	Charleton Isle, in *James's Bay*	52	00	N	301	30

	Places Names.	Lat. D.	Lat. M.		Long. D.	Long. M.
Islands in the *West-Indies.*	*Bermudus*	32	30	N	318	00
	Santa Cruz	17	42	N	320	00
	St. Christophers	17	30	N	321	00
	Antego	16	28	N	322	00
	Marigallanta	15	42	N	322	10
	Martineco	14	20	N	322	00
	Port Royal in *Jamaico*	17	50	N	304	15
	Barbadoes	13	24	N	323	30
	Tobago	10	54	N	324	20
	Trinidado	09	20	N	322	30
	Mevis	16	42	N	320	40
	Monserat	16	02	N	321	30
	Margaretta	11	00	N	319	30
	St. Domingo	18	30	N	313	05
	Cape Nicolao in Hispaniola	19	57	N	309	10
	Cape Roxo in Portereco	17	54	N	317	20
	Cape Antonio on Cuba	21	52	N	296	50
	Cape Crux on Cuba	19	40	N	302	30
	Cape Maye on Cuba	20	25	N	308	10
	The *Havana on Cuba*	23	28	N	299	00
	Isle of Ash	18	20	N	309	20

The Explanation and Use of the Table of Latitude and Longitude.

IN the Table there are five Columns; The first shews the Sea-Coasts about the World in general; the second particular places; the third shews the Latitude; the fourth shews whether the Latitude be North or South, in which N stands for North, and S for South Latitude; the fifth and last shews the Longitude, being accounted Easterly from the Meridian of *Pico* on *Teneriff.*

The

To find the Latitude and Longitude of Places.

Suppose the Latitude and Longitude of *Silly* be desired.

Look in the Table for the Coast of *England* in the first Column, and in the second for *Silly*, over against which, in the third Column, stands 50° 12′, and in the fourth N, which shews the Latitude of *Silly* to be 50° 12′ North; the last Column gives 14° 10′, which is the Longitude from *Pico Teneriff* aforesaid.

To find the Difference of Longitude between two places.

Rule.

First, Look out their Longitudes in the Table, subtract the lesser Longitude out of the greater, and if the Remainder be less than 180°, that is the Difference of Longitude; but if it be more, subtract it from 360°, and then the Remainder is the Difference of Longitude.

Example 1.

What is the Difference of Longitude between *Bermudus* and *Cape Cod* in *New-England*.

The Longitude of *Bermudus* is	318° 00′
The Longitude of *Cape Cod* is	316° 40′
The Diff. of Longitude required	1° 20′

Example 2.

What is the Difference of Longitude between *Cape Cod* in *New-England* and the *Lizard*?

The Longitude of *Cape Cod*	316° 40′
The Longitude of the *Lizard*	15° 00′
Greater than 180°	291° 40′
Therefore subtract it from	360° 00′
The Diff. of Longitude required	068° 20′

To know whether the Difference of Longitude between two places be Easterly or Westerly.

First, When the first Remainder is less than 180°, then being bound to the place that hath the least Longitude, the Difference of Longitude is Westerly; but if bound to the place that hath the greater Longitude, it is Easterly.

Secondly, When the said first Remainder is greater than 180°, then if bound to the place, having the greater Longitude, the Difference of Longitude is Westerly; if to that which hath the less r, it is Easterly.

Prob.

Problems of Plain Sailing, Wrought both by the Logarithms, and by Gunters Scale.

PROBLEM I.

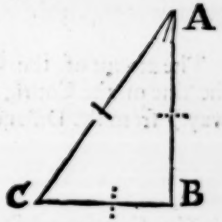
THe Course and Distance being given, to find the Difference of Latitude and Departure.

Example.

Suppose a Ship sail South-West by South 382 min. and it be required to find the Difference of Latitude and Departure.

In the Triangle A B C.

A C represents the Distance sailed.
A B the Difference of Latitude.
B C the Departure.
B A C (or the Angle at A) the Angle of the Course.
A C B (or the Angle at C) the Complement of the Course to 90°.



Characters used in Navigation *and* Astronomy.

S. Stands for Sine.
T. For Tangent.
Sc. Sine Complement.
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The given sides and angles of a Triangle are marked with a dash thus (′)
The required sides and Angles with pricks thus (⋮)

The Operation by the Logarithms, *for the Difference of Latitude.*

As Radius	10.00000
To the Distance sailed 382	2.58206
So is Sc. of the Course 56 deg. 15 min.	9.91984
To the Difference of Latitude 317 required.	2.50190

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The Longitude of *Cape Cod* —— ——	316° 40′
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Therefore subtract it from —— ——	360° 00′
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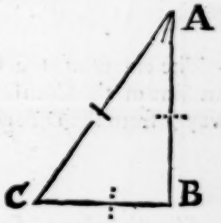

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The Operation by the Logarithms, *for the Difference of Latitude.*

As Radius	10.00000
To the Distance sailed 382	2.58206
So is Sc. of the Course 56 deg. 15 min.	9.91984
To the Difference of Latitude 317 required.	2.50190

For the Departure.

As Radius	10.00000
To the Distance sailed 382	2.58206
So is S. of the Course 33 deg. 45 min.	9.74473
To the Departure, which is 212	2.32679

The Operation by the Gunter's *Scale.*

For the Difference of Latitude.

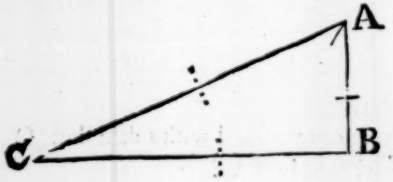
One foot of the Compasses being in the Radius, (or Sine of 90 deg.) extend the other to the Sine of 56° 15′ the Complement of the Course, and the same extent shall reach the same way (*viz.* decreasing) from the Distance 382, to the Difference of Latitude 317, which was required.

For the Departure.

The extent of the Compasses from the Radius (or Sine of 90°) to the Sine of the Course 33° 45′, the same extent shall reach (the same way) from the Distance 382 to the Departure, which is 212.

PROBLEM II.

The Course and Difference of Latitude given, to find the Distance and Departure.



Example.

Suppose a Ship sail W.S.W. until the Difference of Latitude be 219, and the Distance and Departure required.

By the Logarithms.

For the Distance.

As Sc. of the Course 22° 30′	9.58284
To the Difference of Latitude 219	2.34044
So is Radius	10.00000
To the Distance, which is 572	2.75760

For

For the Departure.

As Radius	10.00000
To the Diſtance 572	2.75739
So is S. of the Courſe 67° 30′	9.96561
To the Departure, which is 528	2.72300

By the Gunter.

For the Diſtance.

The Compaſſes being extended from the Sc. of the Courſe 22° 30′ to the Radius, the ſame extent ſhall reach the ſame way, (*viz.* increaſing) from the the Difference of Latitude 219, to the Diſtance, which is 572.

For the Departure.

The extent of the Compaſſes from Radius, to the S. of the Courſe 67° 30′, ſhall reach (the ſame way) from the Diſtance 572 to the Departure, which is 528.

PROB. III.

The Courſe and Departure given, to find the Diſtance and Difference of Latitude.

Example.

Suppoſe a Ship ſail North-Eaſt by Eaſt, until the Departure be 220, the Diſtance and Difference of Latitude required.

By the Logarithms.

For the Diſtance.

As S of the Courſe 56° 15′	9.91984
To the Departure 220	2.34242
So is Radius	10.00000
To the Diſtance, which is 264	2.42258

For the Difference of Latitude.

As Radius	10.00000
To the Diſtance 264	2.42160
So is Sc. of the Courſe 33° 45′	9.74473
To the Diff. of Lat. which is 146	2.16633

By the Gunter.

For the Diſtance.

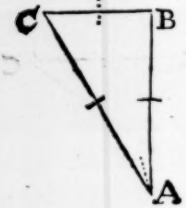
The Extent of the Compaſſes from the S. of the Courſe 56° 15′ to the Radius, ſhall reach (the ſame way) from the Departure 220, to the Diſtance, which is 264.

For the Difference of Latitude.

The Extent of the Compaſſes from Radius to the Sc. of the Courſe 33° 45′, ſhall reach from the Diſtance 264, to the Difference of Latitude 146 required.

PROBLEM IV.

The Diſtance and Difference of Latitude given, to find the Courſe and Departure.



Example.

Suppoſe a Ship ſail between the North and the Weſt 206 min. until the Difference of Latitude be 197, the Courſe and Departure required.

By the Logarithms.

For the Courſe.

As the Diſtance 206	2.31386
To Radius	10.00000
So is the Difference of Latitude 197	2.29446
To Sc. of Courſe, which is 17° N. W.	9.98060

For

For the Departure.

As Radius	10.00009
To the Diſtance 206	2.31386
So is S. of the Courſe 17° 00′,	9.46593
To the Departure, which is 60	1.77979

By the Gunter.

For the Courſe.

The Extent from the Diſtance 206, to the Difference of Latitude 197, ſhall reach from Radius to the S. of 73° 00′, the Complement of the Courſe, which ſubtracted from 90°, is the Courſe required.

For the Departure.

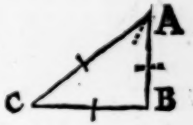
The Extent from Radius S. 90°, to the S. of the Courſe 17° 00′, ſhall reach from the Diſtance 206, to the Departure 60 required.

PROBLEM V.

The Diſtance and Departure given, to find the Courſe and Difference of Latitude.

Example.

Suppoſe a Ship ſail between the South and the Weſt 247 minutes, until her Departure be 197, and it be required to find her Courſe and Difference of Latitude.



The Operation by the Logarithms.

For the Courſe.

As the Diſtance 247	2.39269
To Radius	10 00000
So is the Departure 197	2.29446
To the S. of the Courſe, which is 52° 54′	9.90177

For

For the difference of Latitude.

As Radius	10.00000
To the Diſtance 247	2.39269
So is Sc. of the Courſe 37° 06′	9.78046
To the Diff. of Lat. which is 149	2.17315

By the Gunter.

For the Courſe.

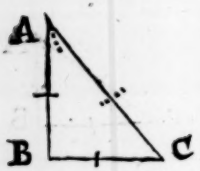
The Extent of the Compaſſes from the Diſtance 247, to the Departure 197, ſhall reach the ſame way from Radius S. 90°, to the S. of the Courſe, which is 52° 54′.

For the Difference of Latitude.

The Extent of the Compaſſes from Radius S. 90°, to the Sc. of the Courſe 37° 6′, will reach from the Diſtance 247, to the Difference of Latitude, which is 149.

PROB. VI.

The Difference of Latitude and departure given, to find the Courſe and Diſtance.



Example.

Suppoſe a Ship ſail between the South and the Eaſt, until her Difference of Latitude be 210′, her Departure 200, and it be required to find the Courſe and Diſtance.

The Operation by the Logarithms.

For the Courſe.

As the Difference of Latitude 210	2.32221
To Radius	10.00000
So is the Departure 200	2.30103
To the T. of the Courſe 43° 36′ req.	9.97882

For

For the Diſtance.

As the Sc. of the Courſe 46° 24′	9.85984
To the Difference of Latitude 210	2.32221
So is Radius	10.00000
To the Diſtance, which is 290	2.46237

By the Gunter.

For the Courſe.

The Extent of the Compaſſes from the Difference of Latitude 210, to the Departure 200, ſhall reach from Radius in the Tangents, which is the Tangent of 45°, to the Tangent of the Courſe, which is 43° 36′.

For the Diſtance.

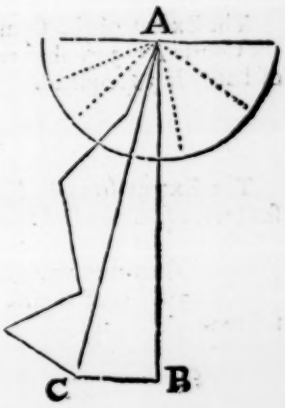
The Extent from the Sc. of the Courſe 46° 24′, to the Radius the S. of 90°, will reach from the Difference of Latitude 210, to the Diſtance, which is 290.

PROB. VII.

This Problem ſhews the manner of working a Traverſe, and is very uſeful in keeping a Reckoning by Plain Sailing.

Example.

Suppoſe a Ship bound to a certain Port, and ſhe ſails thither S. S. W. 40 min. then South-Weſt 60 min. then South by Eaſt 63 min. W. S. W. 49 min. then S. E. by S. 56 min. and the Difference of Latitude and Departure the Ship hath made, with the direct Courſe and Diſtance is required.



The Operation by the Logarithms.

For the Difference of Latitude for the first Course.

As Radius	10.00000
To the Distance 40	1.60006
So is Sc. of the Course 67° 30′	9.96561
To the Difference of Latitude 36	1.56567

For the Departure for the first Course.

As Radius	10.00000
To the Distance 40	1.60006
So is S. of the Course 22° 30′	9.58283
To the Departure 15 required	1.18289

By the Gunter.

For the Difference of Latitude.

The Extent of the Compasses from Radius S. 90°, to the Sc. of the Course 67° 30′, shall reach from the Distance 40, to the Difference of Latitude 36 required.

For the Departure.

The Extent from Radius S. 90, to the S. of the Course 22° 30′, shall reach from the Distance 40, to the Departure 15 required.

In the same manner proceed to find the Difference of Latitude and Departure for each Course; which being found, place in a Table as follows.

The

The Traverſe Table.

Courſes.	Diſt.	North	South.	Eaſt.	Weſt.
South South-weſt.	40		36		15
South-Weſt.	60		42		42
South by Eaſt.	63		61	12	
W. S. W.	49		18		45
S. E. by South.	56		46	31	
			203	43	102
					43
					59

The Explanation of the Table.

For the placing the Difference of Latitude and Departure in their proper Columns; Obſerve, that if the Courſe be North, the Difference of Latitude is put in the North Column; if it be South, in the South Column; and if the Courſe be Eaſterly, the Departure is put in the Eaſt Column; if Weſterly, in the Weſt Column.

Thus having framed the Table, add up the North, South, Eaſt and Weſt Columns, whereby the Difference of Latitude appears to be 203 min. South, becauſe there's nothing in the North Column; the Departure 59 min. Weſt, becauſe by ſo much the Weſt Column exceeds the Eaſt; by which Difference of Latitude and Departure, find the direct Courſe and Diſtance as follows.

The Operation by the Logarithms.

For the direct Courſe.

As the Difference of Latitude 203	2.30749
To Radius	10.00000
So is the Departure 59	1.77085
To the T. of the Courſe 16° 12′ S. W. becauſe the South and Weſt Columns exceed the North and Eaſt.	9.46336

For the Direct Distance.

As Sc. of the Course 73° 48′	9.98240
To the Difference of Latitude 203	2.30749
So is Radius	10.00000
To the Dist. required, which is 211	2.32509

By the Gunter.

For the direct Course.

The Extent of the Compasses from the Difference of Latitude 203, to the Departure 59, shall reach from Tang. 45° (or Radius) to the Tang. of 16° 12′, the Course required.

For the direct Distance.

The Extent from the Sc. of the Course 73° 48′ to S. of 90°, (*viz.* Radius) shall reach from the Difference of Latitude 203, to the Distance 211 required.

Oblique-angled Plain Triangles, applied in Problems of Plain Sailing, and wrought both by the Logarithms and Gunter's *Scale.*

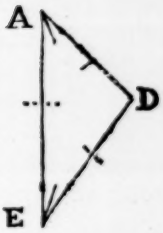
PROBLEM I.

THe Angles, and one of the Sides given, to find either of the other Sides.

Example.

Suppose there are two Ports both under one Meridian: a Ship sails from the Northermost South-East 206 min. another Ship sails from the Southermost North-East by North, a certain number of minutes, and meets with the first Ship; The Distance between the two Ports, and the Distance sailed by the second Ship, are required.

In



In the Triangle A D E.

A and E represents the two Ports.
A D the first Ships Distance.
E D the second Ships Distance.
A E the Distance between the two Ports.

The Operation by the Logarithms.

For the Distance between the two Ports.

	Co. Ar.
As S. A E D the second Ships Course 33° 45′ —	0.25527
To A D the first Ships Distance 206 —	2.31386
So is S. A D E 101° 15′ —	9.99157
To A E the Distance between the two Ports 363.	*l* 2.56070

In this Operation, to save the labour of the subtraction, use the Complement Arithmetical of the first Logarithm, which is found by subtracting each figure of the Logarithm found in the Table from 9, save the first towards the right hand, which is subtracted from 10, as in the Operation the Logarithm Sine found in the Table is 974473; wherefore beginning at the left hand, say; 9 from 9, there remains 0, 7 from 9 remains 2, 4 from 9 remains 5, 4 from 9 remains 5, 7 from 9 remains 2; and lastly, 3 from 10 and there remains 7: So the Complement Arithmetical of the first Logarithm, is 0.25527, as it stands in the Operation.

For the second Ships Distance.

	Co. Ar.
As S. A E D the second Ships Course 33° 45′ —	0.25527
To A D the first Ships Distance 206′ —	2.31386
So is S. D A E the first Ships Course 45° 00′ —	9.84948
To D E the second Ships Dist. 262 required —	*l* 2.4861

By the Gunter.

For the Distance between the two Ports

The Extent of the Compasses from the S. of 33° 45′ the first Ships Course, to S. A D E 78° 45′, (*viz.* the Complement of 101° 15′ to 18°)

For the Direct Distance.

As Sc. of the Course 73° 48′	9.98240
To the Difference of Latitude 203	2.30749
So is Radius	10.00000
To the Dist. required, which is 211	2.32509

By the Gunter.

For the direct Course.

The Extent of the Compasses from the Difference of Latitude 203, to the Departure 59, shall reach from Tang. 45° (or Radius) to the Tang. of 16° 12′, the Course required.

For the direct Distance.

The Extent from the Sc. of the Course 73° 48′ to S. of 90°, (*viz.* Radius) shall reach from the Difference of Latitude 203, to the Distance 211 required.

Oblique-angled Plain Triangles, applied in Problems of Plain Sailing, and wrought both by the Logarithms and Gunter's *Scale.*

PROBLEM I.

THe Angles, and one of the Sides given, to find either of the other Sides.

Example.

Suppose there are two Ports both under one Meridian: a Ship sails from the Northermost South-East 206 min. another Ship sails from the Southermost North-East by North, a certain number of minutes, and meets with the first Ship; The Distance between the two Ports, and the Distance sailed by the second Ship, are required.

In

In the Triangle A D E.

A and E represents the two Ports.
A D the first Ships Distance.
E D the second Ships Distance.
A E the Distance between the two Ports.

The Operation by the Logarithms.

For the Distance between the two Ports.

	Co. Ar.
As S. A E D the second Ships Course 33° 45′ —	0.25527
To A D the first Ships Distance 206 ———	2.31386
So is S. A D E 101° 15′ ———	9.99157
To A E the Distance between the two Ports 363.	12.56070

In this Operation, to save the labour of the subtraction, use the Complement Arithmetical of the first Logarithm, which is found by subtracting each figure of the Logarithm found in the Table from 9, save the first towards the right hand, which is subtracted from 10, as in the Operation the Logarithm Sine found in the Table is 974473; wherefore beginning at the left hand, say; 9 from 9, there remains 0, 7 from 9 remains 2, 4 from 9 remains 5, 4 from 9 remains 5, 7 from 9 remains 2; and lastly, 3 from 10 and there remains 7: So the Complement Arithmetical of the first Logarithm, is 0.25527, as it stands in the Operation.

For the second Ships Distance.

	Co. Ar.
As S. A E D the second Ships Course 33° 45′ —	0.25527
To A D the first Ships Distance 206′ ———	2.31386
So is S. D A E the first Ships Course 45° 00′ —	9.84948
To D E the second Ships Dist. 262 required —	12.4861

By the Gunter.

For the Distance between the two Ports

The Extent of the Compasses from the S. of 33° 45′ the first Ships Course, to S. A D E 78° 45′, (*viz.* the Complement of 101° 15′ to 18°)

180°) ſhall reach from 206 the firſt Ships diſtance, to 363 the diſtance between the two Ports required.

For the ſecond Ships Diſtance.

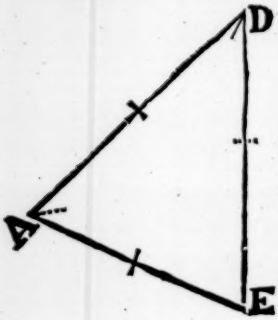
The Extent of the Compaſſes from the S. of 33° 45′ the firſt Ships Courſe, to the S. of 45° 00′ the ſecond Ships Courſe, ſhall reach from 206 the firſt Ships Diſtance, to 262 the ſecond Ships diſtance required.

PROBLEM II.

Two Sides and an Angle oppoſite to one of them being given, to find the other oppoſite Angle, and the third Side.

Example.

Suppoſe two Ports whoſe bearing is North-Eaſt and South-Weſt, diſtant 396 min. a Ship at the Northermoſt ſails S. S. E. and another Ship at the Southermoſt ſails thence 518 min. and meets with the firſt Ship. The Courſe ſailed by the ſecond Ship, and the firſt Ships diſtance are required.



In the Triangle A D E.

A and D repreſents the two Ports.

A D the Diſtance between them.

D E the Diſtance ſailed by the firſt Ship.

A E the Diſtance ſailed by the ſecond Ship.

The Operation by the Logarithms.

For the ſecond Ships Courſe.

	Co. Ar.
As A E the ſecond Ships Diſtance 518 ——	7.28568
To S. A D E the firſt Ships Courſe 67° 30′ ——	9.96561
So is A D the Diſt. between the two Ports 396 —	2.59769
To S. A E D 44° 50′——	19.84898

Now

Now the Angle at D 67° 30′, and the Angle at E 44° 56′ being added together, and ſubtracted from 180°, gives 67° 34′, which makes neareſt 6 Points: and 6 Points reckoned from the North-Eaſt to the Southward, gives E. S. E. the ſecond Ships Courſe required.

For the firſt Ships Diſtance.

	Co. Ar.
As S. A D E the firſt Ships Courſe 67° 30′ ——	0.03439
To A E the ſecond Ships Diſtance 418 —— ——	2.71432
So is S. D A E the ſecond Ships Courſe 44° 56′ —	9.84897
To D E the firſt Ships Diſtance 395 required ——	2.59768

By the Gunter.

For the ſecond Ships Courſe.

The Extent of the Compaſſes from the Diſtance 518, to the Diſtance between the two Ports 396, ſhall reach from S. of 67° 30′ the firſt Ships Courſe, to S. 44° 56′, which added to the Angle at D, and the Sum ſubtracted from 108°, gives 67° 34′, the ſecond Ships Courſe.

For the firſt Ships Diſtance.

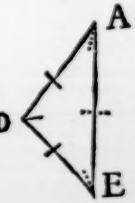
The Extent from the S. of 67° 30′ the firſt Ships Courſe, to 44° 56′ ſhall reach from the ſecond Ships Diſtance 518, to the firſt Ships Diſtance 395 required.

PROBLEM III.

Two Sides and the contained Angle given, to find the other Angles.

Example.

Suppoſe two Ships ſail from one Port; one ſails North-Eaſt 140 min. The other South-Eaſt by Eaſt 115 min. The Bearing and Diſtance of theſe two Ships is required.



Let D repreſent the Port, DA the firſt Ships Diſtance, and D E the ſecond.

The

The Operation by the Logarithms.

For the bearing of the two Ships.

	Co. Ar.
As the Sum of the Sides A D and D E 255	7.59346
To the difference of the said Sides 25	1.39794
So is the T. of ½ the Sum of their oppoſite Angles 50° 37′	10.08569
To the T. of ½ their difference which is 6° 48′	X9.07709

The ½ difference added to the ½ ſum gives 57° 25′, the greater Angle. The ½ difference ſubtracted from it, gives 43° 49′, the leſſer Angle: Wherefore the Bearing of the two Ships is North-Eaſterly, or South-Weſterly. 1° 11′.

For the Diſtance of the Ships.

	Co. Ar.
As S. A E D 57° 25′	0.07438
To A D the firſt Ships diſtance 140	2.14612
So is S. A D E 77° 45′	9.99157
To A E the diſtance of the Ships 163 *fere*	X2.21207

By the Gunter.

For the Bearing of the Ships.

The Extent of the Compaſſes from the ſum of the ſides 255, to their difference 25, ſhall reach from the T. of the half ſum of the required Angles 50° 37′, to the T. of half the difference of the ſaid Angles 6° 48′.

In the foregoing Operation by the *Gunter*, the Practitioner may be at a loſs, becauſe in extending the Compaſſes from the T. of 50° 37′ decreaſing, they will fall beyond the T. of 45° at the end of the Line. To remedy this, place the Extent (from 255 to 25) from the T. 45°, and it will reach to the T. of 5° 36′: then letting one Point ſtand at 5° 36′, extend the other to the T. of 50° 37′; this Extent placed from the T. 45°, ſhall fall on the T. 6° 48′ required.

For

For the diſtance of the Ships.

The Extent from the S. of 57° 25′, to the S. 78° 45′, ſhall reach from 140 to 163 required.

PROBLEM IV.

Three ſides being given, to find an Angle.

Example.

Suppoſe there are two Ports both in one Latitude, diſtant 536 min. a Ship ſails from the Eaſtermoſt 306 min. between the South and the Weſt; another Ship ſails from the Weſtermoſt 290 min. and meets with the firſt Ship; the Courſe that each Ship ſteered is required.

Let A and E repreſent the two Ports, D the place where the Ships meet.

This queſtion is eaſieſt reſolved, by letting fall the Perpendicular D B, ſo reducing the Oblique-Triangle A D E, into the two Right-Angled Triangles A B D, and B D E, then the Operation is as follows.

The Operation by the Logarithms.

First, Find the Segment of the Baſe B E, thus;

	Co. Ar.
As the Baſe A E 536	7.27084
To the ſum of the Sides A D and E D 596	2.77524
So is the difference of the ſaid Sides 16	1.20412
To a Segment of the Baſe, which is 16	11.25020

The whole Baſe is — 536
The Segment is — 17
Sum — — 553
Half Sum — 276 $\frac{1}{2}$ is the greater Segment B E.

Then

Then ſay, *For the firſt Ships Courſe.*

As D E the firſt Ships diſtance 306 —— 2.48572
To Radius —— 10.00000
So is the greater Segment B E 276 —— 2.44090
To S. 64° 25′ the Comp. of the Courſe required — 9.95518

The firſt Ship ſteers Weſt 25° 35′ South, or South-Weſt by Weſt ¾ Weſt *ferè*.

For the ſecond Ships Courſe.

As A D the ſecond Ships Diſtance 290 —— 2.46239
To Radius —— 10.00000
So is the leſſer Segment A B 260 —— 2.41497
To S. 63° 42′ the Comp. of the Courſe required — 9.95258

The ſecond Ship ſteers Eaſt 26° 18′ South, or South-Eaſt by Eaſt ¾ Eaſt *ferè*.

By the Gunter.

For the Segment of the Baſe.

The Extent of the Compaſſes from the Baſe A E 536, to the Sum of the Sides 596, ſhall reach from the Difference of the Sides 16, to the Segment of the Baſe 17, with which proceed as before.

For the firſt Ships Courſe.

The Extent from the Diſtance 306, to the greater Segment 276, ſhall reach from Radius S. 90° to S. 64° 25′, the Complement of the Courſe required.

For the ſecond Ships Courſe.

The Extent from the Diſtance 290, to the leſſer Segment 260, ſhall reach from Radius S. 90° to S. 63° 42′, the Complement of the Courſe required.

A

A Large and very Useful

TABLE

OF

DIFFERENCE

OF

Latitude & Departure,

IN

Minutes and Tenth Parts, to every *Degree* and *Quarter-Point*

OF THE

COMPASS:

For the Exact Working

OF A

TRAVERS.

London, Printed by *John Darby* for *William Fisher*, at the Postern-Gate near *Tower-Hill*, 1677.

Dist.	1 Deg.		2 Deg.		¼ Point.		3 Deg.		4 Deg.		5 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	01.0	00.0	01.0	00.0	01.0	00.0	01.0	00.0	01.0	00.1	01.0	00.1	1
2	02.0	00.0	02.0	00.1	02.0	00.1	02.0	00.1	02.0	00.1	02.0	00.2	2
3	03.0	00.1	03.0	00.1	03.0	00.1	03.0	00.2	03.0	00.2	03.0	00.3	3
4	04.0	00.1	04.0	00.1	04.0	00.2	04.0	00.2	04.0	00.3	04.0	00.3	4
5	05.0	00.1	05.0	00.2	05.0	00.2	05.0	00.3	05.0	00.3	05.0	00.4	5
6	06.0	00.1	06.0	00.2	06.0	00.3	06.0	00.3	06.0	00.4	06.0	00.5	6
7	07.0	00.1	07.0	00.2	07.0	00.3	07.0	00.4	07.0	00.5	07.0	00.6	7
8	08.0	00.1	08.0	00.3	08.0	00.4	08.0	00.4	08.0	00.6	08.0	00.7	8
9	09.0	00.2	09.0	00.3	09.0	00.4	09.0	00.5	09.0	00.6	09.0	00.8	9
10	10.0	00.2	10.0	00.4	10.0	00.5	10.0	00.5	10.0	00.7	10.0	00.9	10
11	11.0	00.2	11.0	00.4	11.0	00.5	11.0	00.6	11.0	00.8	11.0	01.0	11
12	12.0	00.2	12.0	00.4	12.0	00.6	12.0	00.6	12.0	00.8	12.0	01.0	12
13	13.0	00.2	13.0	00.5	13.0	00.6	13.0	00.7	13.0	00.9	12.9	01.1	13
14	14.0	00.2	14.0	00.5	14.0	00.7	14.0	00.7	14.0	01.0	13.9	01.2	14
15	15.0	00.3	15.0	00.5	15.0	00.7	15.0	00.8	15.0	01.0	14.9	01.3	15
16	16.0	00.3	16.0	00.6	16.0	00.8	16.0	00.8	16.0	01.1	15.9	01.4	16
17	17.0	00.3	17.0	00.6	17.0	00.8	17.0	00.9	17.0	01.2	16.9	01.5	17
18	18.0	00.3	18.0	00.6	18.0	00.9	18.0	00.9	17.9	01.3	17.9	01.6	18
19	19.0	00.3	19.0	00.7	19.0	00.9	19.0	01.0	18.9	01.3	18.9	01.7	19
20	20.0	00.4	20.0	00.7	20.0	01.0	20.0	01.0	19.9	01.4	19.9	01.7	20
21	21.0	00.4	21.0	00.7	21.0	01.0	21.0	01.1	20.9	01.5	20.9	01.8	21
22	22.0	00.4	22.0	00.8	22.0	01.1	22.0	01.1	21.9	01.5	21.9	01.9	22
23	23.0	00.4	23.0	00.8	23.0	01.1	23.0	01.2	22.9	01.6	22.9	02.0	23
24	24.0	00.4	24.0	00.8	24.0	01.2	24.0	01.3	23.9	01.7	23.9	02.1	24
25	25.0	00.4	25.0	00.9	25.0	01.2	25.0	01.3	24.9	01.7	24.9	02.2	25
26	26.0	00.5	26.0	00.9	26.0	01.3	26.0	01.4	25.9	01.8	25.9	02.3	26
27	27.0	00.5	27.0	00.9	27.0	01.3	27.0	01.4	26.9	01.9	26.9	02.4	27
28	28.0	00.5	28.0	01.0	28.0	01.4	28.0	01.5	27.9	02.0	27.9	02.4	28
29	29.0	00.5	29.0	01.0	29.0	01.4	29.0	01.5	28.9	02.0	28.9	02.5	29
30	30.0	00.5	30.0	01.1	30.0	01.5	30.0	01.6	29.9	02.1	29.9	02.6	30
31	31.0	00.5	31.0	01.1	30.9	01.5	31.0	01.6	30.9	02.2	30.9	02.7	31
32	32.0	00.6	32.0	01.1	31.9	01.6	31.9	01.7	31.9	02.2	31.9	02.8	32
33	33.0	00.6	33.0	01.2	32.9	01.6	32.9	01.7	32.9	02.3	32.9	02.9	33
34	34.0	00.6	34.0	01.2	33.9	01.7	33.9	01.8	33.9	02.4	33.9	03.0	34
35	35.0	00.6	35.0	01.2	34.9	01.7	34.9	01.8	34.9	02.4	34.9	03.1	35
36	36.0	00.6	36.0	01.3	35.9	01.8	35.9	01.9	35.9	02.5	35.9	03.1	36
37	37.0	00.7	37.0	01.3	36.9	01.8	36.9	01.9	36.9	02.6	36.9	03.2	37
38	38.0	00.7	38.0	01.3	37.9	01.9	37.9	02.0	37.9	02.7	37.9	03.3	38
39	39.0	00.7	39.0	01.4	38.9	01.9	38.9	02.0	38.9	02.7	38.9	03.4	39
40	40.0	00.7	40.0	01.4	39.9	02.0	39.9	02.1	39.9	02.8	39.8	03.5	40
41	41.0	00.7	41.0	01.4	40.9	02.0	40.9	02.1	40.9	02.9	40.8	03.6	41
42	42.0	00.7	42.0	01.5	41.9	02.1	41.9	02.2	41.9	02.9	41.8	03.7	42
43	43.0	00.8	43.0	01.5	42.9	02.1	42.9	02.2	42.9	03.0	42.8	03.8	43
44	44.0	00.8	44.0	01.5	43.9	02.2	43.9	02.3	43.9	03.1	43.8	03.8	44
45	45.0	00.8	45.0	01.6	44.9	02.2	44.9	02.4	44.9	03.1	44.8	03.9	45
46	46.0	00.8	46.0	01.6	45.9	02.2	45.9	02.4	45.9	03.2	45.8	04.0	46
47	47.0	00.8	47.0	01.6	46.9	02.3	46.9	02.5	46.9	03.3	46.8	04.1	47
48	48.0	00.8	48.0	01.7	47.9	02.3	47.9	02.5	47.9	03.4	47.8	04.2	48
49	49.0	00.9	49.0	01.7	48.9	02.4	48.9	02.6	48.9	03.4	48.8	04.3	49
50	50.0	00.9	50.0	01.8	49.9	02.4	49.9	02.6	49.9	03.5	49.8	04.4	50
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	89 Deg.		88 Deg.		7½ Poin.		87 Deg.		86 Deg.		85 Deg.		

Dist.	1 Deg.		2 Deg.		¼ Point		3 Deg.		4 Deg.		5 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	51.0	00.9	51.0	01.8	50.9	02.5	50.9	02.7	50.9	03.6	50.8	04.4	51
52	52.0	00.9	52.0	01.8	51.9	02.5	51.9	02.7	51.9	03.6	51.8	04.5	52
53	53.0	00.9	53.0	01.8	52.9	02.6	52.9	02.8	52.9	03.7	52.8	04.6	53
54	54.0	00.9	54.0	01.9	53.0	02.6	53.9	02.8	53.9	03.8	53.8	04.7	54
55	55.0	01.0	55.0	01.9	54.9	02.7	54.9	02.9	54.9	03.8	54.8	04.8	55
56	56.0	01.0	56.0	02.0	55.9	02.7	55.9	02.9	55.9	03.9	55.8	04.9	56
57	57.0	01.0	57.0	02.0	56.9	02.8	56.9	03.0	56.9	04.0	56.8	05.0	57
58	58.0	01.0	58.0	02.0	57.9	02.8	57.9	03.0	57.9	04.1	57.8	05.1	58
59	59.0	01.0	59.0	02.1	58.9	02.9	58.9	03.1	58.8	04.1	58.8	05.2	59
60	60.0	01.0	60.0	02.1	59.5	02.9	59.9	03.1	59.8	04.2	59.8	05.2	60
61	61.0	01.1	61.0	02.1	60.9	03.0	60.9	03.2	60.8	04.3	60.8	05.3	61
62	62.0	01.1	62.0	02.2	61.9	03.0	61.9	03.3	61.8	04.3	61.8	05.4	62
63	63.0	01.1	63.0	02.2	62.9	03.1	62.9	03.3	62.8	04.4	62.8	05.5	63
64	64.0	01.1	64.0	02.2	63.9	03.1	63.9	03.4	63.8	04.5	63.8	05.6	64
65	65.0	01.1	65.0	02.3	64.9	03.2	64.9	03.4	64.8	04.5	64.7	05.7	65
66	66.0	01.1	66.0	02.3	65.9	03.2	65.9	03.5	65.8	04.6	65.7	05.8	66
67	67.0	01.2	67.0	02.3	66.9	03.3	66.9	03.5	66.8	04.7	66.7	05.9	67
68	68.0	01.2	67.9	02.4	67.9	03.3	67.9	03.6	67.8	04.8	67.7	05.9	68
69	69.0	01.2	68.9	02.4	68.9	03.4	68.9	03.6	68.8	04.8	68.7	06.0	69
70	70.0	01.2	69.9	02.4	69.9	03.4	69.9	03.7	69.8	04.9	69.7	06.1	70
71	71.0	01.2	70.9	02.5	70.9	03.5	70.9	03.7	70.8	05.0	70.7	06.2	71
72	72.0	01.3	71.9	02.5	71.9	03.5	71.9	03.8	71.8	05.0	71.7	06.3	72
73	73.0	01.3	72.9	02.5	72.4	03.6	72.9	03.8	72.8	05.1	72.7	06.4	73
74	74.0	01.3	73.9	02.6	73.9	03.6	73.9	03.9	73.8	05.2	73.7	06.5	74
75	75.0	01.3	74.9	02.6	74.9	03.7	74.9	03.9	74.8	05.2	74.7	06.6	75
76	76.0	01.3	75.9	02.7	75.9	03.7	75.9	04.0	75.8	05.3	75.7	06.6	76
77	77.0	01.3	76.9	02.7	76.9	03.8	76.9	04.0	76.8	05.4	76.7	06.7	77
78	78.0	01.4	77.9	02.7	77.9	03.8	77.9	04.1	77.8	05.5	77.7	06.8	78
79	79.0	01.4	78.9	02.8	78.9	03.9	78.9	04.1	78.8	05.5	78.7	06.9	79
80	80.0	01.4	79.9	02.8	79.9	03.9	79.9	04.2	79.8	05.6	79.7	07.0	80
81	81.0	01.4	80.9	02.8	80.9	04.0	80.9	04.2	80.8	05.7	80.7	07.1	81
82	82.0	01.4	81.9	02.9	81.9	04.0	81.9	04.3	81.8	05.7	81.7	07.2	82
83	83.0	01.4	82.9	02.9	82.9	04.1	82.9	04.4	82.8	05.8	82.7	07.3	83
84	84.0	01.5	83.9	02.9	83.9	04.1	83.9	04.4	83.8	05.9	83.7	07.3	84
85	85.0	01.5	84.9	03.0	84.9	04.2	84.9	04.5	84.8	05.9	84.7	07.4	85
86	86.0	01.5	85.9	03.0	85.9	04.2	85.9	04.5	85.8	06.0	85.7	07.5	86
87	87.0	01.5	86.9	03.0	86.9	04.3	86.9	04.6	86.8	06.1	86.7	07.6	87
88	88.0	01.5	87.9	03.1	87.9	04.3	87.9	04.6	87.8	06.2	87.7	07.7	88
89	89.0	01.5	88.9	03.1	88.9	04.4	88.9	04.7	88.8	06.2	88.7	07.8	86
90	90.0	01.6	89.9	03.1	89.9	04.4	89.9	04.7	89.8	06.3	89.7	07.9	90
91	91.0	01.6	90.9	03.2	90.9	04.5	90.9	04.8	90.8	06.4	90.7	08.0	91
92	92.0	01.6	91.9	03.2	91.9	04.5	91.9	04.8	91.8	06.4	91.6	08.0	92
93	93.0	01.6	92.9	03.2	92.9	04.6	92.0	04.9	92.8	06.5	92.6	08.1	93
94	94.0	01.6	93.9	03.3	93.9	04.6	93.9	04.9	93.8	06.6	93.6	08.2	44
95	95.0	01.6	94.9	03.3	94.9	04.7	94.9	05.0	94.8	06.6	94.6	08.3	95
96	96.0	01.7	95.9	03.4	95.9	04.7	95.9	05.0	95.8	06.7	95.6	08.4	96
97	97.0	01.7	96.9	03.4	96.9	04.8	96.9	05.1	96.8	06.8	96.6	08.5	97
98	98.0	01.7	97.9	03.4	97.9	04.8	97.9	05.1	97.8	06.9	97.6	08.6	98
99	99.0	01.7	98.9	03.5	98.9	04.9	98.9	05.2	98.8	06.9	98.6	08.7	99
100	100.0	01.7	99.9	03.5	99.9	04.9	99.9	05.2	99.8	07.0	99.6	08.7	100
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	D.p	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	89 Deg.		88 Deg.		7 ½ Point		87 Deg.		86 Deg.		85 Deg.		

Dist.	¼ Point.		6 Deg.		7 Deg.		8 Deg.		¾ Point.		9 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.1	01.0	00.2	1
2	02.0	00.2	02.0	00.2	02.0	00.2	02.0	00 3	02.0	00.3	02.0	00.3	2
3	03.0	00.3	03.0	00.3	03.0	00.4	03.0	00.4	03.0	00.4	03.0	00.5	3
4	04.0	00.4	04.0	00.4	04.0	00.5	04.0	00.6	04.0	00.6	03.9	00.6	4
5	05.0	00.5	05.0	00.5	05.0	00.6	04 9	00.7	04.9	00.7	04.9	00.8	5
6	06.0	00.6	00.6	00 6	06.0	00.7	05 9	00 8	05 9	00.9	05.9	00.9	6
7	07.0	00.7	00.7	00.7	06 0	00.8	06.9	01.0	06.9	01.0	06 9	01.1	7
8	08.0	00.8	00 8	00.8	07 9	01.0	07.9	01.1	07.9	01.2	07.9	01.2	8
9	09.0	00.9	00.8	00.9	08.9	01.1	08.9	01.2	08 9	01.3	08.9	01.4	9
10	09.9	01 0	01.9	01.0	09.9	01 2	09.9	01.4	09.9	01.5	09.9	01.6	10
11	10.9	01.1	10.9	01.1	10.9	01.3	10.9	01.5	10.9	01.6	10.9	01.7	11
12	11.9	01.2	11.9	01 2	11.9	01.5	11 9	01.7	11.9	01.8	11.8	01.9	12
13	12.9	01.3	12.9	01.4	12.9	01.6	12.9	01.8	12.9	01.9	12.8	02 0	13
14	13.9	01.4	13.9	01.5	13.9	01.7	13.9	01.9	13.8	02.1	13.8	02.2	14
15	14.9	01.5	14.9	01.6	14.9	01.8	14.8	02.1	14.8	02 2	14.8	02.3	15
16	15.9	01.6	15.9	01.7	15.9	01.9	15.8	02.2	15.8	02.3	15.8	02.5	16
17	16.9	01.7	16.9	01.8	16.9	02.1	16.8	02.4	16.8	02.5	16.8	02 7	17
18	17.9	01.8	17.9	01.9	17.9	02.2	17.8	02.5	17.8	02.6	17.8	02 8	18
19	18.9	01.9	18.9	02.0	18.9	02.3	18 8	02.6	18.8	02.8	18.8	03.0	19
20	19.9	02.0	19.9	02.1	19.8	02.4	19.8	02.8	19.8	02.9	19.7	03 1	20
21	20.9	02.1	20.9	02.2	20.8	02.6	20.8	02.9	20.8	03.1	20.7	03.3	21
22	21.9	02.2	21.9	02.3	21.8	02.7	21.8	03.1	21.8	03.2	21.7	03.4	22
23	22.9	02.2	22.9	02.4	22.8	02 8	22.8	03.2	22.7	03.4	22.7	03.6	23
24	23.9	02.3	23.9	02.5	23.8	02 9	23.8	03.3	23.7	03.5	23.7	03.8	24
25	24.9	02 4	24.9	02.6	24.8	03.0	24.8	03.5	24.7	03.7	24.7	03.9	25
26	25.9	02.5	25.9	02.7	25.8	03.2	25.7	03.6	25.7	03.8	25.7	04.1	26
27	26.9	02.6	26.9	02.8	26.8	03 3	26.7	03.7	26.7	04.0	26.7	04.2	27
28	27.9	02.7	27.8	02.9	27.8	03.4	27.7	03.9	27.7	04 1	27.6	04.4	28
29	28.9	02.8	28.8	03.0	28.8	03.5	28 7	04.0	28.7	04 2	28 6	04.5	29
30	29.8	02.9	29.8	03.1	29.8	03.7	29.7	04.2	29.7	04.4	29.6	04.7	30
31	30.8	03.0	30.8	03 2	30.8	03.8	30.7	04.3	30.7	04.5	30.6	04.9	31
32	31.8	03.1	31.8	03.3	31.8	03.9	31.7	04.4	31.6	04.7	31.6	05.0	32
33	32.8	03.2	32 8	03.4	32.7	04.0	32.7	04.6	32.6	04.8	32.6	05.2	33
34	33.8	03.3	33.8	03.5	33.7	04.1	33 7	04.7	33.6	05.0	33.6	05.3	34
35	34.8	03 4	34.8	03.7	34 7	04.3	34.7	04.9	34.6	05.1	34.6	05.5	35
36	35.8	03.5	35.8	03.8	35.7	04 4	35.6	05.0	35.6	05.3	35.5	05.6	36
37	36.8	03.6	36.8	03.9	36 7	04.5	36.6	05.1	36 6	05.4	36.5	05.8	37
38	37.8	03.7	37.8	04.0	37.7	04.6	37.6	05.3	37.6	05.6	37.5	06.0	38
39	38.8	03.8	38.8	04.1	38.7	04 8	38 6	05.4	38 6	05.7	38 5	06.1	39
40	39.8	03.9	39.8	04.2	39.7	04.9	39 6	05.6	39.6	05.9	39.5	06.3	40
41	40.8	04.0	40.8	04.3	40.7	05.0	40.6	05.7	40.6	06 0	40.5	06 4	41
42	41.8	04.1	41.8	04.4	41.7	05.1	41.6	05.8	41 5	06 2	41.5	06.6	42
43	42.8	04.2	42.8	04.5	42 7	05 2	42.6	06.0	42.5	06.3	42.5	06.7	43
44	43.8	04.3	43.7	04.6	43.7	05.4	43 6	06.1	43.5	06.5	43.5	06.9	44
45	44.8	04 4	44.7	04.7	44 7	05.5	44.6	06.3	44.5	06 6	44.4	07.0	45
46	45.8	04.5	45.7	04 8	45.7	05.6	45.5	06.4	45.5	06 7	45.4	07.2	46
47	46.8	04.6	46.7	04.9	46.6	05.7	46.5	06.5	46.5	06.9	46.4	07.3	47
48	47.8	04.7	47.7	05 0	47.6	05.9	47.5	06.7	47.5	07 0	47.4	07.5	48
49	48.8	04.8	48.7	05.1	48.6	06.0	48.5	06.8	48.5	07.2	48.4	07.7	49
50	49.8	04.9	49.7	05.2	49.6	06.1	19.5	07.0	49.5	07.3	49.4	07.8	50
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	7 ½ Poin.		84 Deg.		83 Deg.		82 Deg.		7 ¼ Point		81 Deg.		

Dif.	½ Point.		6 Deg.		7 Deg.		8 Deg.		¾ Point.		9 Deg.		Dif.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	50.7	05.0	50.7	05.3	50 6	06.2	50.5	07.1	50 4	07 5	50 4	08.0	51
52	51.7	05.1	51 7	05 4	51 6	06.3	51.5	07.2	51.4	07.6	51.4	08.1	52
53	52.7	05.2	52.7	05 5	52.6	06.5	52.5	07.4	52 4	07 8	52 3	08.3	53
54	53.7	05.3	53.7	05.6	53 6	06 6	53.5	07.5	53.4	07.9	53.3	08.4	54
55	54.7	05.4	54.7	05.8	54.6	06.7	54.5	07.6	54.4	08.1	54 3	08.6	55
56	55.7	05.5	55.7	05.8	55.6	06.7	55.5	07.8	55.4	08.2	55.3	08.7	56
57	56.7	05.6	56.7	06.0	56.6	06.9	56.4	07.9	56.4	08.4	56.3	08.9	57
58	57.7	05.7	57.7	06.1	57 6	07.1	57 4	08.1	57.4	08.5	57.3	09.1	58
59	58.7	05.8	58.7	06.2	58.6	07 2	58.4	08.2	58.4	08.7	58.3	09.2	59
60	59.7	05.9	59.7	06 3	59.5	07 3	59.4	08.3	59.3	08.8	59.3	09.4	60
61	60.7	06.0	60.7	06.4	60.5	07.4	60.4	08.5	60 3	08 9	60 2	09.5	61
62	61.7	06.1	61.6	06.5	61.5	07.6	61.4	08.6	61.3	09.1	61.2	09.7	62
63	62.7	06.2	62.6	06.6	62.5	07.7	62.4	08.8	62 3	09.2	62.2	09.9	63
64	63.7	06.3	63.6	06.7	63.5	07.8	63.4	08 9	63 3	09.4	63.2	10 0	64
65	64.7	06.4	64.6	06.8	64 5	07.9	64.4	09.1	64.3	09 5	64.2	10.2	65
66	65.7	06.5	65.6	06 9	65.5	08 0	65.4	09 2	65.3	09.7	65.2	10 3	66
67	66.7	06 6	66.6	07.0	66.5	08.2	66.3	09.3	66.3	09.8	66.2	10 5	67
68	67.7	06.7	67.6	07.1	67.5	08.3	67 3	09.5	67.3	10.0	67.2	10.6	68
69	68.7	06.8	68.6	07.2	68.5	08.4	68.3	09.6	68.2	10 1	68.1	10.8	69
70	69.7	06.9	69 6	07.3	69.5	08.5	69.3	09 7	69.2	10.3	69.1	10.9	70
71	70 6	07.0	70.6	07.4	70.5	08.7	70.3	09.9	70.2	10 4	70.1	11.1	71
72	71.6	07.1	71.6	07.5	71.5	08 8	71.3	10.0	71.2	10.6	71.1	11.3	72
73	72.6	07.1	72 6	07.6	72.4	08.9	72.3	10.2	72.2	10.7	72.1	11.4	73
74	73.6	07.2	73.6	07.7	73.4	09.0	73.3	10.3	73.2	10.9	73.1	11.6	74
75	74 6	07.3	74.6	07.8	74.4	09.1	74 3	10.4	74.2	11.0	74.1	11.7	75
76	75.6	07.4	75.6	07.9	75.4	09.3	75.3	10.6	75.2	11.1	75.1	11.9	76
77	76.6	07 5	76.6	08.0	76.4	09.4	76.2	10.7	76.2	11.3	76.0	12.0	77
78	77.6	07.6	77.6	08.1	77 4	09.5	77.2	10.9	77.1	11.4	77.0	12.2	78
79	78.6	07.7	78.6	08.3	78.4	09.6	78.2	11.0	78.1	11.6	78.0	12.4	79
80	79.6	07.8	79.6	08.4	79.4	09.8	79.2	11.1	79.1	11 7	79 0	12 5	80
81	80.6	07.9	80.5	08.5	80 4	09.9	80.2	11.3	80.1	11 9	80 0	12.7	81
82	81 6	08 0	81.5	08 6	81.4	10 0	81.2	11.4	81.1	12.0	81.0	12 8	82
83	82.6	08.1	82.5	08.7	82.4	10 0	82.2	11.5	82.1	12.2	82.0	13.0	83
84	83.6	08.2	83.5	08.8	83.4	10.1	83 2	11.7	83.1	12.3	83 0	13.1	84
85	84.6	08.3	84.5	08.9	84 4	10 3	84.2	11.8	84.1	12.5	83.9	13 3	85
86	85 6	08.4	85.5	09.0	85.4	10.4	85.2	12.0	85.1	12.6	84.9	13.4	86
87	86 6	08.5	86.5	09.1	86.3	10.5	86.1	12.1	86.0	12.8	85.9	13.6	87
88	87.6	08.6	87 5	09.2	87.3	10.7	87.1	12 2	87 0	12.9	86.9	13.8	88
89	88.6	08.7	88.5	09.3	88.3	10.9	88.1	12.4	88.0	13.1	87.9	13.9	89
90	89 6	08.8	89 5	09.4	89 3	11 0	89.1	12.5	89.0	13.2	88.9	14.1	90
91	90 6	08 9	90 5	09.5	90.3	11 1	90.1	12.7	90.0	13.4	89.9	14.2	91
92	91.6	09.0	91.5	09 6	91.3	11.2	91.1	12 8	91.0	13.5	90.9	14.4	92
93	92 6	09.1	92.5	09 7	92.3	11.3	92.1	12.9	92.0	13.6	91.8	14 5	93
94	93 5	09.2	93.5	09.8	93 3	11.5	93.1	13.1	93.0	13.8	92.8	14.7	94
95	94.5	09.3	94.5	09.9	94 3	11.6	94 1	13.2	94.0	13.9	93.8	14.9	95
96	95.5	09.4	95 5	10.0	95.3	11.7	95.1	13.4	95.0	14.1	94.8	15.0	96
97	96.5	09 5	96.5	10.1	96.3	11 8	96.0	13.5	95.9	14 2	95.8	15.2	97
98	97.5	09.6	97.5	10 2	97.3	12.0	97.0	13.6	96.9	14 4	96 8	15.3	98
99	98.5	09 7	98 5	10.3	98 3	12.1	98.0	13.8	97 9	14.5	97.8	15.5	99
100	99.5	09.8	99.4	10.4	99.2	12.2	99.0	13.9	98.9	14.7	98.8	15.6	100
Dif.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dif.
	7 ½ Poin		84 Deg.		83 Deg.		82 Deg.		7 ¼ Poin		81 Deg.		

Dist.	10 Deg. Lat.	10 Deg. Dep	11 Deg. Lat.	11 Deg. Dep	1 Point. Lat.	1 Point. Dep	12 Deg. Lat.	12 Deg. Dep	13 Deg. Lat.	13 Deg. Dep	14 Deg. Lat.	14 Deg. Dep	Dist.
1	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	01.0	00.2	1
2	02.0	00.3	02.0	00.4	02.0	00.4	02.0	00.4	01.9	00.4	01.9	00.5	2
3	02.9	00.5	02.9	00.6	02.9	00.6	02.9	00.6	02.9	00.7	02.9	00.7	3
4	03.9	00.7	03.9	00.8	03.9	00.8	03.9	00.8	03.9	00.9	03.9	01.0	4
5	04.9	00.9	04.9	00.9	04.9	01.0	04.9	01.0	04.9	01 1	04.8	01.2	5
6	05.9	01 0	05.9	01.1	05.9	01.2	05 9	01.2	05.8	01.3	05.8	01.4	6
7	06.9	01.2	06.9	01.3	06.9	01.4	06.8	01.5	06.8	01.6	06.8	01 7	7
8	07.9	01.4	07.8	01.5	07.8	01 6	07.8	01.7	07.8	01.8	07.8	01.9	8
9	08.9	01.6	08.8	01.7	08.8	01.8	08 8	01.9	08.8	02.0	08.7	02.2	9
10	09 8	01.7	09 8	01.9	09.8	01.9	09.8	02.1	09.7	02.2	09.7	02.4	10
11	10.8	01.9	10	02.1	10.8	02.1	10.8	02.3	10.7	02.5	10.7	02.7	11
12	11 8	02.1	11.8	02.3	11.8	02 3	11.7	02.5	11.7	02.7	11.6	02.9	12
13	12.8	02.3	12.8	02.5	12.7	02.5	12.7	02.7	12.7	02.9	12.6	03.1	13
14	13.8	02.4	13.7	02.7	13.7	02.7	13.7	02.9	13.6	03.1	13.6	03.4	14
15	14.8	02.6	14.7	02.9	14.7	02 9	14.7	03.1	14.6	03.4	14 5	03.6	15
16	15.7	02.8	15.7	03.0	15.7	03.1	15.6	03.3	15 6	03 6	15.5	03.9	16
17	16.7	02.9	16.7	03.2	16.7	03.3	16.6	03.5	16.6	03.8	16.5	04 1	17
18	17 7	03.1	17.7	03.4	17.7	03.6	17.6	03.7	17.5	04.0	17.5	04 4	18
19	18.7	03.3	18.6	03.6	18.6	03.7	18.6	03.9	18.5	04.2	18.4	04.6	19
20	19.7	03.5	19.6	03.8	19.6	03.9	19.6	04.2	19.5	04.5	19.4	04.8	20
21	20.7	03.6	20 6	04 0	20.6	04.1	20.5	04.4	20.5	04.7	20.4	05.1	21
22	21.7	03.8	21.6	04.2	21.6	04.3	21.5	04.6	21.4	04.9	21.3	05.3	22
23	22.6	04.0	22.6	04.4	22.6	04.5	22.5	04.8	22.4	05.2	22.3	05.6	23
24	23.6	04.2	23.6	04.6	23.5	04.7	23.5	05.0	23.4	05.4	23.3	05.8	24
25	24.6	04.3	24.5	04.8	24.5	04.9	24.	05.2	24.3	05.6	24.3	06.0	25
26	25.6	04.5	25.5	05 0	25.5	05.1	25.4	05.4	25.3	05.8	25.2	06.3	26
27	26.6	04.7	26.5	05.1	26.5	05.3	26.4	05.6	26.3	06.1	26.2	06.5	27
28	27.6	04.9	27 5	05.3	27.5	05.5	27.4	05.8	27.3	06.3	27.2	06.8	28
29	28.6	05.0	28.5	05.5	28.4	05.7	28.4	06.0	28.2	06.5	22.1	07.0	29
30	29.5	05.2	29.4	05.7	29.4	05.8	29.3	06 2	29.2	06.7	29.1	07.3	30
31	30.5	05.4	30.4	05 9	30.4	06 0	30.3	06.4	30.2	07.0	30.1	07.5	31
32	31.5	05.5	31.4	06.1	31.4	06.2	31.3	06.6	31 2	07.2	31.0	07.7	32
33	32 5	05.7	32.4	06.3	32.4	06.4	32.3	06.9	32.1	07.4	32 0	08 0	33
34	33.5	05.9	33.4	06.5	33.3	06.6	33.2	07.1	33.1	07.6	33.0	08 2	34
35	34.5	06 1	34.4	06.7	34.3	06.8	34.2	07.3	34 1	07 9	34 0	08 5	35
36	35.4	06.2	35.3	06.9	35.3	07.0	35.2	07.5	35.1	08.1	34.9	08.7	36
37	36 4	06.4	36.3	07.1	36.3	07.2	36 2	07 7	36.0	08 3	35.9	09.0	37
38	37.4	06 6	37.3	07.2	37.3	07.4	37.2	07.9	37.0	08.5	36.9	09.2	38
39	38.4	06.8	38.3	07.4	38 2	07.6	38.1	08.1	38.0	08.8	37.8	09.4	39
40	39 4	06.9	39.3	07 6	39.2	07.8	39.1	08.3	39 0	09.0	38.8	09.7	40
41	40.4	07.1	40 2	07.8	40.2	08.0	40.1	08.5	39.9	09.2	39.8	09.9	41
42	41.4	07.3	41.2	08.0	41.2	08.2	41.1	08.7	40 9	09.4	40.7	10.2	42
43	42.3	07.5	42.2	08.2	42.2	08.4	42.1	08.9	41.9	09.7	41.7	10.4	43
44	43.3	07.7	43.2	08.4	43.1	08.6	43.0	09.1	42.9	09.9	42.7	10 6	44
45	44.3	07.8	44.2	08.6	44.1	08.8	44.0	09.4	43 8	10.1	43.7	11.0	45
46	45.3	08.0	45.2	08.8	45.1	09.0	45.0	09.6	44.8	10.3	44.6	11.1	46
47	46.3	08.1	46.1	09.0	46.1	09.2	46.0	09.8	45.8	10.6	45.6	11.4	47
48	47.3	08.3	47.1	09.2	47.1	09.4	47 0	10 0	46.8	10.8	46.6	11.6	48
49	48.3	08.5	48.	09.3	48.1	09.6	47.9	10.2	47 7	11 0	47.5	11 9	49
50	49.2	08.7	4911	09.5	49.0	09.8	48.9	10.4	48.7	11 2	48 5	12.1	50
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	80 Deg.		79 Deg.		7 Point.		78 Deg.		77 Deg.		76 Deg.		

Dist.	10 Deg.		11 Deg.		1 Point.		12 Deg.		13 Deg.		14 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	50.2	08.8	50.1	09.7	50 0	10 0	50 0	10.6	49.7	11.5	49 5	12.3	51
52	51.2	09.0	51 0	09 9	51 0	10.1	50.9	10.8	50 7	11 7	50.5	12.6	52
53	52.2	09.2	52 0	10.1	52.0	10 3	51.8	11.0	51.6	11 9	51.4	12 8	53
54	53.2	09.4	53.0	10 3	53.0	10.5	52.8	11.2	52 6	12.1	52 4	13.1	54
55	54.2	09.5	54.0	10 5	53.9	10.7	53.8	11.4	53.6	12.4	53.4	13 3	55
56	55.1	09.7	55.0	10.7	54.9	10.9	54.8	11.6	54.5	12.6	54 3	13.5	56
57	56.1	09.9	56 0	10.8	55.9	11 1	55.8	11.8	55.5	12 8	55.3	13.8	57
58	57.1	10.1	56.9	11.1	56.9	11.3	56.7	12.1	56.5	13.0	56.3	14.0	58
59	58.1	10.2	57 9	11.3	57.9	11.5	57.7	12 3	57.5	13.3	57.2	14.3	59
60	59.1	10.4	58 9	11.4	58.8	11.7	58.7	12.5	58.5	13.5	58.2	14 5	60
61	60.1	10.6	59.9	11.6	59.8	11 9	59.7	12.7	59.4	13.7	59.2	14 8	61
62	61.1	10.8	60.9	11.8	60.8	12.1	60.6	12.9	60 4	13.9	60.2	15.0	62
63	62.0	10.9	61.8	12.0	61.8	12.3	61.6	13.1	61.4	14.2	61.1	15.2	63
64	63.0	11.1	62.8	12.2	62.8	12.5	62.6	13.3	62.3	14 4	62.1	15.5	64
65	64.0	11.3	63.8	12.4	63.7	12.7	63.6	13.5	63 3	14.6	63.1	15.7	65
66	65.0	11.5	64.8	12 6	64 7	12 9	64.6	13.7	64.3	14.8	64.0	16.0	66
67	66.0	11.6	65.8	12.8	65.7	13.1	65.5	13.9	65.3	15.1	65.0	16.2	67
68	67.0	11.8	66.7	13.0	66.7	13.3	66.5	14.1	66.2	15.3	66.0	16.4	68
69	68.0	12.0	67.7	13.2	67.7	13.5	67.5	14.3	67.2	15.5	66.9	16.7	69
70	68.9	12.2	68 7	13.4	68.7	13.7	68.5	14.5	68.2	15.7	67.9	16.9	70
71	69.9	12.3	69.7	13.5	69.6	13.9	69.4	14.8	69.2	16.0	68.9	17.2	71
72	70.9	12.5	70.7	13.7	70.6	14.0	70.4	15.0	70.1	16.2	69.9	17.4	72
73	71.6	12.7	71 7	13.9	71.6	14.2	71.4	15.2	71.1	16.4	70.8	17.6	73
74	72.9	12.8	72.6	14.1	72.6	14.4	72 4	15.4	72.1	16.6	71.8	17.9	74
75	73 9	13.0	73.6	14.3	73.6	14.6	73.4	15.6	73.1	16.9	72.8	18.1	75
76	74.8	13.2	74.6	14.5	74.5	14.8	74 3	15.8	74.0	17.1	73.7	18.4	76
77	75.8	13.4	75.6	14.7	75.5	15.0	75.3	16.0	75.0	17.3	74.7	18.6	77
78	76.8	13.5	76.6	14.9	76.5	15.2	76.3	16 2	76.0	17 5	75.7	18.9	78
79	77.8	13.7	77.5	15.1	77.5	15 4	77.3	16.4	77 0	17.8	76.6	19.1	79
80	78.8	13.9	78.5	15.3	78.5	15.6	78 2	16.6	77.9	18.0	77.6	19.3	80
81	79 8	14.1	79.5	15.5	79.4	15.8	79.2	16.8	78.9	18.2	78.6	19.4	81
82	80 8	14.2	80.5	15.6	80 4	16.0	80.2	17.0	79.9	18.4	79.6	19.8	82
83	81.7	14.4	81.5	15.8	81.4	16.2	81.2	17.2	80.9	18.7	80 5	20.1	83
84	82.7	14.6	82.5	16.0	82.4	16 4	82.2	17.5	8158	18.9	81.5	20.3	84
85	83.7	14.8	83.4	16.2	83.4	16.6	83.1	17.7	82.8	19.1	82.5	20.6	85
86	84 7	14.9	84.4	16.4	84.3	16.8	84.1	17.9	83.8	19.3	83.4	20 8	86
87	85 7	15.1	85 4	16.6	85.3	17.0	85.1	18.1	84.8	19.6	84.4	21.0	87
88	86.7	15.3	86.4	16.8	86.3	17 2	86.1	18.3	85.7	19 8	85.4	21.3	88
89	87.6	15.4	87.4	17.0	87.3	17.4	87.1	18.5	86.7	20.0	86.4	21.5	89
90	88 6	15.6	88.3	17.2	88.3	17.6	88.0	18.7	87 7	20.2	87.3	21.8	90
91	89 6	15.8	89 3	17.4	89 2	17.8	89.0	18.9	88.7	20 5	88.3	22.0	91
92	90.6	16.0	90.3	17.6	90.2	17.9	90.0	19.1	89.6	20.7	89.3	22.2	92
93	91 6	16.1	91.3	17.7	91.2	18 1	91.0	19 3	90.6	20.9	90.2	22 5	93
94	92.6	16.3	92.3	17.9	92.2	18.3	91.9	19.5	91.6	21.1	91.2	22.7	94
95	93.5	16.5	93.3	18.1	93 2	18.5	92.9	19.7	92.6	21.4	92.2	23.0	95
96	94.5	16.7	94 2	18.3	94 2	18 7	93.9	20.0	93.5	21.6	93.1	23.2	96
97	95.5	16.8	95.2	18.5	95.1	18.9	94 9	20.2	94.5	21.0	94.1	23.5	97
98	96.5	17.0	96.2	18.7	96.1	19.1	95.9	20.4	95.5	21.8	95.1	23.7	98
99	97.5	17 2	97.2	18.9	97.1	19.3	96.8	20 6	96.5	22.3	96 1	23.9	99
100	98.5	17.4	98.2	19.1	98.1	19.5	97.8	20 8	97.4	22.5	97.0	24.2	100
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	80 Deg.		79 Deg.		7 Point.		78 Deg.		77 Deg.		76 Deg.		

Dist.	¼ Point.		15 Deg.		16 Deg.		1 ½ Poin		17 Deg.		18 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	La.	Dep	Lat.	Dep	Lat.	Dep	
1	01.0	00.2	01.0	00.3	01.0	00.3	01.0	00.3	01.0	00.3	00.9	00.3	1
2	01.9	00.5	01.9	00.5	01.9	00.5	01.9	00.6	01.9	00.6	01.9	00.6	2
3	02.9	00.7	02.9	00.8	02.9	00.8	02.9	00.9	02.9	00.9	02.8	00.9	3
4	03.9	01.0	03.9	01.0	03.8	01.1	03.8	01.2	03.8	01 2	03.8	01.2	4
5	04.8	01.2	04.8	01.3	04.8	01.4	04.8	01 5	04.8	01.5	04.8	01.5	5
6	05.8	01.5	05.8	01.5	05 8	01.6	05 8	01 7	05.7	01.7	05.7	01.8	6
7	06.8	01.7	06.8	01.8	06.8	01.9	06.8	02.0	06.7	02.0	06.7	02.2	7
8	07.8	01.9	07.7	02.1	07.7	02.2	07.7	02.3	07.6	02.3	07 6	02 5	8
9	08.7	02.2	08.7	02.3	08.6	02.5	08 6	02.6	08.6	02.6	08.6	02.8	9
10	09 7	02 4	09 7	02.6	09.6	02.8	09.6	02.9	09.6	02.9	09 5	03.1	10
11	10.7	01.8	10.6	02.8	10.6	03.0	10.5	03.2	10.5	03.2	10 5	03.4	11
12	11 6	02.9	11.6	03.1	11.5	03.3	11.5	03.5	11 5	03.5	11.4	03.7	12
13	12.6	03.2	12.6	03.4	12.5	03.6	12.4	03.8	12.4	03.8	12.4	04.0	13
14	13.6	03.4	13.5	03.6	13.5	03.9	13.4	04.1	13.4	04.1	13.3	04 3	14
15	14.5	03.6	14.5	03.9	14.4	04.1	14.4	04.4	14 3	04.4	14 3	04.6	15
16	15.5	04.0	15.5	04.1	15.4	04.4	15.3	04.6	15 3	04.7	15.2	04.9	16
17	16.5	04.1	16.4	04.4	16.3	04.7	16.3	04.9	16.3	05.0	16.2	05.2	17
18	17 5	04.4	17.4	04.7	17.3	05.0	17.2	05.2	17.2	05.3	17.1	05.6	18
19	18.4	04.6	18.4	04.9	18.3	05.2	18.2	05.5	18.2	05.5	18.1	05.9	19
20	19 4	04.9	19.3	05.2	19.2	05.5	19.1	05.8	19.1	05.8	19.0	06.2	20
21	20.4	05.1	20 3	05.4	20.2	05.8	20.1	06.1	20.1	06.1	20 0	06.5	21
22	21.3	05.3	21.2	05.7	21.1	06.1	21.0	06 4	21.0	06.4	20.9	06.8	22
23	22.3	05.6	22.2	06.0	22.1	06.3	22.0	06.7	22.0	06.7	21.9	07.1	23
24	23.3	05.8	23.2	06.2	23.1	06.6	23.0	06.8	22.9	07.0	22.8	07.4	24
25	24.2	06.0	24.1	06.5	24.0	06.9	23.9	07.3	23.9	07.3	23.8	07.7	25
26	25.2	06.3	25.1	06.7	24.9	07.2	24.9	07.5	24.9	07.6	24.7	08 0	26
27	26.2	06.6	26.1	07.0	25.9	07.4	25.8	07.8	25.8	07.9	25.7	08 3	27
28	27.2	06.8	27.0	07.2	26.9	07.7	26.8	08.1	26.8	08.2	26.6	08 6	28
29	28.1	07 0	28 0	07.5	27.8	08.0	27.8	08.4	27.7	08.5	27.6	09.0	29
30	29.1	07.3	29.0	07.8	28 8	08.3	28.7	08.7	28.7	08.8	28.5	09.3	30
31	30.1	07.5	29.9	08.0	29.8	08.5	29.7	09 0	29.6	09.1	29.5	09.6	31
32	31.0	07.9	30.9	08.3	30.7	08.8	30.6	09.3	30.6	09.3	30.4	10.0	32
33	32.0	08.0	31.9	08.5	31.7	09.1	31.6	09.6	31 6	09.6	31.4	10.2	33
34	33.0	08.3	32.8	08.8	32 7	09.4	32.5	09.9	32.5	09.9	32 3	10.5	34
35	33.9	08.5	33.8	09.0	33 6	09.6	33.5	10.2	33.5	10.2	33.3	10.8	35
36	34 9	08.7	34.8	09 3	34.6	09.9	34.4	10.4	34 4	10.5	34.2	11.1	36
37	35 9	09.0	35.7	09.6	35.6	10.2	35.4	10.7	35.4	10.8	35.2	11.4	37
38	36.9	09.2	36.7	09.8	36.5	10.5	36 4	11.0	36.3	11.1	36.1	11.7	38
39	37.8	09.5	37.7	10.1	37.5	10.7	37.3	11.3	37.3	11 4	37.1	12.0	39
40	38 8	09.7	38.6	10.3	38 4	11.0	38.3	11.6	38.2	11.7	38.0	12.4	40
41	39.8	10.0	39.6	10.6	39 4	11 3	39.2	11.9	39.2	12 0	39.0	12.7	41
42	40.7	10.2	40.6	10.9	40.4	11.6	40.2	12.2	40 2	12.3	39.9	13.0	42
43	41.7	10.4	41.5	11.1	41.3	11.8	41.1	12 5	41.1	12.6	40.9	13.3	43
44	42.7	10.7	42.5	11.5	42.3	12.1	42 1	12.8	42.1	12.9	41.8	13 6	44
45	43.6	10.9	43.5	11.6	43.2	12.4	43.1	13.1	43 0	13.1	42.8	13.9	45
46	44.6	11.2	44.4	11.9	44.2	12.7	44.0	13 3	44.0	13.4	43 7	14.2	46
47	45.6	11.4	45.4	12.2	45.2	12.9	45.0	13 6	44.9	13.7	44.7	14.5	47
48	46.6	11.7	46.4	12.4	46.1	13.2	45.9	13.9	45.9	14.0	45.6	14.8	48
49	47.5	11.9	47.3	12.7	47 1	13.5	46.9	14.2	46.9	14.3	46.6	15.1	49
50	48.5	12.1	48.3	12.9	48.1	13.8	47 8	14.5	47 8	14.6	47.5	15.4	50
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	6 ¾ Poin		75 Deg.		74 Deg.		6 ½ Poin		73 Deg.		72 Deg.		

Dist.	¼ Point		15 Deg.		16 Deg.		1 ½ Poin		17 Deg.		18 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	49.5	12.4	49.3	13.2	48.0	14.0	48.8	14.8	48.8	14.9	48.5	15.8	51
52	50.4	12.6	50.2	13.5	49.0	14.3	49.7	15.1	49.7	15.2	49.4	16.1	52
53	51.4	12.9	51.2	13 7	50.9	14 6	50.7	15.3	50.7	15.5	50.4	16.4	53
54	52.4	13.1	52 2	14.0	51.9	14.9	51 7	15.7	51.6	15.8	51.3	16.7	54
55	53.3	13 4	53.1	14.2	52.9	15.2	52 6	16.0	52.6	16.1	52.3	17 0	55
56	54.3	13 6	54.1	14.5	53.8	15.4	53.6	16.2	53 5	16.4	53 3	17.3	56
57	55.3	13.8	55.1	14.8	54.8	15.7	54.5	16.5	54.5	16.7	54.2	17.6	57
58	56.3	14.1	56.0	15 0	55.7	16.0	55.5	16.8	55.5	17.0	55 2	17.9	58
59	57.2	14.3	57.0	15.3	56.7	16.3	56 5	17.1	56.4	17.2	56.1	18.2	59
60	58.2	14.6	58.0	15.5	57 7	16.5	57.4	17.4	57.4	17.5	57.1	18.5	60
61	59.2	14.0	58.9	15.8	58.6	16.8	58.4	17.7	58.3	17.8	58 0	18.8	61
62	60 1	15.1	59.9	16.1	59.6	17.1	59.3	18.0	59.3	18.1	59.0	19 2	62
63	61.1	15.3	60.8	16.3	60.5	17.4	60.3	18.3	60.2	18.4	59.9	19.5	63
64	62.1	15.5	61.8	16.6	61.5	17.6	61.2	18.6	61.2	18.7	60.9	19.8	64
65	63.0	15.8	62.8	16.8	62.5	17.9	62 2	18.9	62.2	19.0	61.8	20.1	65
66	64.0	16.0	63.7	17.1	63.4	18.2	63.2	19.2	63.1	19.3	62.8	20.4	66
67	65.0	16.3	64.7	17.4	64.4	18.5	64.1	19.4	64.1	19.6	63 7	20.7	67
68	66.0	16.5	65.7	17.6	65.4	18.7	65.1	19 7	65.0	19 9	64 7	21.0	68
69	66.9	16.8	66.6	17.9	66.3	19 0	66.0	20.0	66.0	20.2	65.6	21.3	69
70	67.9	17.0	67.6	18.1	67.3	19.3	67.0	20.4	66.9	20.5	66.6	21.6	70
71	68.9	17.2	68.6	18.3	68.2	19.6	67.9	20.6	67.9	20.8	67.5	21.9	71
72	69.8	17.5	69.5	18.6	69.2	19.8	68.9	20.9	68.8	21.0	68 5	22.2	72
73	70.8	17.7	70.5	18.9	70.2	20.1	69.8	21.2	69.8	21.3	69.4	22.6	73
74	71 8	18.0	71.5	19.1	71.1	20.4	70.8	21.5	70.8	21.6	70.4	22.9	74
75	72.7	18.2	72.4	19.4	72.1	20.7	71.8	21.8	71.7	21 9	71.3	23.2	75
76	73.7	18.5	73.4	19.7	73.0	20.9	72.7	22.1	72 7	22.2	72.3	23.5	76
77	74.7	18.7	74.4	19.9	74.0	21.2	73.7	22.3	73 6	22.5	73.2	23 8	77
78	75.7	18.9	75.3	20.2	75.0	21.5	74.6	22.6	74.6	22 8	74 2	24.1	78
79	76.6	19.2	76.3	20.4	75.9	21.8	75.6	22.9	75.5	23.1	75 1	24 4	79
80	77.6	19.4	77.3	20.7	76.9	22.0	76.6	23.2	76.5	23.4	76.1	24.7	80
81	78.6	19.7	78.2	21.0	77.9	22 3	77 5	23.5	77.5	23.7	77.0	25.0	81
82	79 5	19.9	79.2	21.2	78.8	22.6	78.5	23.8	78 4	24 0	78 0	25.3	82
83	80 5	20.3	80 2	21.5	79.8	22.9	79.4	24.1	79.4	24.3	78.9	25.6	83
84	81.5	20.4	81.1	21.7	80.8	23.1	80.4	24.4	80.3	24.5	79.9	26.0	84
85	82.4	20.7	82.1	22.0	81.7	23.4	81.3	24.7	81.3	24.8	80.8	26.3	85
86	83.4	20.9	83.1	22.3	82 7	23.7	82.3	25.0	82.2	25.1	81.8	26.6	86
87	84.4	21.1	84.0	22.5	83.6	24.0	83.3	25.2	83.2	25.4	82.7	26.9	87
88	85.4	21.4	85 0	22.8	84.6	24.2	84 2	25.5	84.1	25.7	83.7	27.2	88
89	86.3	21.6	86.0	23.0	85 6	24.5	85.2	25.8	85.1	26.0	84.6	27.5	86
90	87.3	21.9	86.9	23.3	86.5	24.8	86 1	26.1	86.1	26.3	85.6	27.8	90
91	88.3	22 1	87.9	23.5	87.5	25.1	87.1	26.4	87.0	26.6	86.5	28.1	91
92	89.2	22.4	88 9	23.8	88.4	25.3	88.0	26.7	88.0	26 9	87.5	28.4	92
93	90 2	22.6	89.8	24.1	89 4	25.6	89.0	27 0	88.9	27.2	88.4	28.7	93
94	91.2	22.8	90.8	24.3	90 4	25.9	90.0	27.3	89.9	27.5	89.4	29 0	44
95	92.1	23.1	91 8	24.6	91.3	26.2	90 9	27 6	90.8	27.8	90.3	29.3	95
96	93.1	23.3	92.7	24.8	92.3	26.4	91.9	27 9	91.8	28.1	91.3	39.7	96
97	94 1	23.6	93.7	25.1	93 2	26.7	92.8	28.2	92.8	28.4	92.3	30.0	97
98	95.1	23.8	94.7	25.4	94 2	27.0	93.8	28.4	93.7	28.6	93.2	30 3	98
99	96.0	24.1	95.6	25.6	95 2	27 3	94 7	28 7	94.7	28.9	94.2	30 6	99
100	97.0	24.3	96.6	25.9	96.1	27 6	95.7	29.0	95 6	29.2	95.1	30.9	100
	Dep	Lat.	Dep	Lat.	Dep	Lat	De	Lat.	Dep	Lat.	Dep	Lat.	
Dist.	6 ¾ Poin		75 Deg.		74 Deg.		6 ½ Poin		73 Deg.		72 Deg.		Dist.

Dist.	19 Deg.		1 ¼ Point		20 Deg.		21 Deg.		22 Deg.		2 Points		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.9	00.3	00.9	00.3	00.9	00.3	00.9	00.4	00.9	00.4	00.9	00.4	1
2	01.9	00.6	01.9	00.7	01.9	00.7	01.9	00.7	01.8	00.7	01.8	00.8	2
3	02.8	01.0	02.8	01.0	02.8	01.0	02.8	01.1	02.8	01.1	02.8	01.1	3
4	03.8	01.3	03.8	01.3	03.8	01.4	03.7	01.4	03.7	01.5	03.7	01.5	4
5	04.7	01.6	04.7	01.7	04.7	01.7	04.7	01.7	04.6	01.9	04.6	01.9	5
6	05.7	01.9	05.6	02.0	05.6	02.0	05.6	02.1	05.6	02.2	05.5	02.3	6
7	06.6	02.3	06.6	02.4	06.6	02.4	06.5	02.5	06.5	02 6	06 5	02.7	7
8	07.6	02.6	07.5	02.7	07.5	02.7	07.5	02.9	07.4	03.0	07.4	03.1	8
9	08.5	02 9	08.5	03.0	08 5	03.1	08.4	03 2	08.3	03.4	08.3	03.4	9
10	09.5	03.3	09.4	03.4	09.4	03.4	09.3	03.6	09 3	03.7	09.2	03.8	10
11	10.4	03.6	10.4	03.7	10.3	03 8	10.3	03.9	10 2	04.1	10.2	04.2	11
12	11.3	03.9	11.3	04.0	11.3	04.1	11 2	04.3	11.1	04 5	11.1	04.6	12
13	12.3	04.2	12.2	04.4	12.2	04.4	12.1	04.7	12.0	04.9	12.0	05.0	13
14	13.2	04.6	13.2	04 7	13.2	04.8	13.1	05.0	13.0	05.2	12.9	05.4	14
15	14.2	04.9	14.1	05.1	14.1	05.1	14.0	05.4	13.9	05.6	13.9	05.7	15
16	15.1	05.2	15.1	05.4	15.0	05 4	14.9	05.7	14.8	06.0	14.8	06.1	16
17	16.1	05.5	16.0	05.7	16.0	05.8	15.9	06.1	15.8	06.4	15.7	06.5	17
18	17.0	05.9	16.9	06.1	16.9	06.3	16.8	06.4	16.7	06.7	16.6	06.8	18
19	18.0	06.1	17.9	06.4	17.9	06.5	17.7	06.8	17.6	07.1	17.6	07.3	19
20	18.9	06.5	18.9	06.7	18.8	06.8	18 7	07.2	18.5	07.5	18.5	07 6	20
21	19.9	06.8	19.8	07.1	19.7	07.2	19.6	07.5	19.5	07.9	19.4	08.0	21
22	20.8	07.2	20.7	07.4	20.7	07.5	20.5	07.9	20.4	08.2	20.3	08 4	22
23	21.7	07.5	21.7	07.7	21.6	07.9	21.5	08.2	21.3	08.6	21.2	08.8	23
24	22.7	07.8	22.6	08.1	22.5	08.2	22.4	08.6	22.2	09.0	22.2	09 2	24
25	23.6	08.1	23.5	08.4	23.5	08 5	23.3	09.0	23.2	09.4	23.1	09.6	25
26	24.6	08.5	24 5	08.8	24.4	08.9	24.3	09 3	24.1	09.7	24.0	09 9	26
27	25.5	08.8	25.4	09.1	25.4	09.2	25.2	09.7	25.0	10.1	24.9	10.3	27
28	26.5	09.1	26.4	09.4	26.3	09 6	26.1	10.0	26.0	10.5	25.9	10.7	28
29	27.4	09.4	27.3	09.8	27.2	09.9	27 1	10.4	26.9	10.9	26.8	11.1	29
30	28.4	09.8	28.2	10.1	28.2	10.3	28 0	10.7	27.8	11.2	27.7	11.5	30
31	29.3	10.1	29.2	10.4	29.1	10.6	28.9	11.1	28.7	11.6	28.6	11.9	31
32	30.3	10.4	30.1	10.8	30.1	10.9	29.1	11.5	29.7	12.0	29.6	12.2	32
33	31.2	10.7	31.1	11.1	31.0	11.3	30.8	11.8	30.6	12.4	30.5	12.6	33
34	32.1	11.1	32 0	11.5	31.9	11.6	31.7	12.2	31.5	12 7	31.4	13.0	34
35	33.1	11.4	33.0	11.8	32.9	12.0	32.7	12.5	32.4	13.1	32.3	13.4	35
36	34.0	11.7	33.9	12.1	33.8	12.3	33.6	12.9	33.4	13.5	33.3	13.8	36
37	35.0	12.1	34.8	12.5	34 8	12.6	34.5	13.3	34.3	13.9	34.2	14.2	37
38	35.9	12.4	35.8	12.8	35.7	13.0	35.5	13.6	35.2	14.2	35.1	14.5	38
39	36.9	12.6	36.7	13.1	36 6	13.3	36.4	14.0	36.2	14.6	36.0	14.9	39
40	37.8	13.0	37.7	13.5	37.6	13.7	37.3	14.3	37.1	15.0	36.9	15.3	40
41	38.8	13.3	38.6	13.8	38.5	14.0	38.3	14 7	38.0	51.3	37.9	15.7	41
42	39.7	13.7	39.5	14.1	39.5	14.4	39.2	15.1	38.9	15.7	38.8	16.1	42
43	40.7	14.0	40.5	14.5	40.4	14.7	40.1	15.4	39.9	16.1	39 7	16.5	43
44	41.6	14.3	41.4	14.8	41.3	15.0	41.1	15.8	40.8	16.5	40.6	16.8	44
45	42.6	14.6	42.4	15.2	42.3	15.4	42.0	16.1	41.7	16.8	41.6	17.2	45
46	43.5	15.0	43.3	15.5	43.2	15.7	42.9	16.5	42.6	17.2	42.5	17.6	46
47	44.4	15.3	44.2	15.8	44.2	16.1	43 9	16.8	43.6	17.6	43.4	18.0	47
48	45.4	15.6	45.2	16.2	45.1	16.4	44.8	17.2	44.5	18.0	44.3	18.4	48
49	46.3	15.9	46.1	16.5	46 0	16 8	45.7	17.6	45.4	18 3	45.3	18.7	49
50	47.3	16.3	47.1	16.8	47.0	17.1	46.7	17.9	46.4	18.7	46.2	19.1	50
Dist.	Dep	Lat	Dep	Lat.	Dep	Lat	Dep	La t	Dep	Lat.	Dep	Lat.	Dist.
	71 Deg.		6 ¼ Point		70 Deg.		69 Deg.		68 Deg.		6 Points		

Dist.	19 Deg.		1 ¼ Poin		20 Deg.		21 Deg.		22 Deg.		2 Points		Dist.
	Lat.	Dep	Lat.	Dep	Lat	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	48·2	16·6	48 0	17·2	47·9	17·4	47.6	18.3	47·3	19.1	47.1	19·5	51
52	49.2	16·9	49.0	17·5	48·9	17 8	48·5	18.6	48.2	19·4	48·0	19 9	52
53	50 1	17·3	49·9	17 9	49·8	18·1	49·5	19 0	49·1	19·8	49·0	20.3	53
54	51·1	17·6	50 8	18.2	50 7	18.5	50·4	19.3	50 1	20.2	49·9	20.7	54
55	52 0	17·9	51·8	18·5	51 7	18.8	51·3	19.7	51.0	20.6	50 8	21.0	55
56	52·9	18.2	52·7	18 9	52.6	19.2	51.3	20·1	51 9	21.0	51.7	21.4	56
57	53·9	18.6	53·7	19 2	53·6	19·5	52.2	20.4	52.8	21·3	52 7	21.8	57
58	54·8	18·9	54·6	19.5	54·5	19 8	54·1	20.8	53·8	21.7	53.6	22.2	58
59	55·8	19·2	55·5	19.9	55·4	20.2	55·1	21.1	54·7	22.1	54 5	22.6	59
60	56·7	19·5	56·5	20·2	56.4	20·5	56.0	21·5	55.6	22.5	55.4	23.0	60
61	57·7	19·9	57·4	20.5	57·4	20·9	56.9	21.9	56.5	22 8	56·3	23·3	61
62	58·6	20·2	58·4	20 9	58·3	21.2	57 9	22·2	57·5	23·2	57·3	23·7	62
63	59.6	20.5	59·3	21 2	59·2	21·5	58.8	22.6	58·4	23·6	58.2	24.1	63
64	60.5	20 8	60·3	21.6	60.1	21·9	59.7	22 9	59·3	24.0	59·1	24·5	64
65	61·5	21.2	61·2	21·9	61·1	22 2	60·7	23.3	60·3	24·3	60 0	24·9	65
66	62.4	21·5	62·1	22.2	62.0	22.6	61·6	23.6	61·2	24.7	61.0	25.3	66
67	63.3	21·8	63·1	22.6	63.0	22.9	62.5	24.0	62.1	25·1	61.9	25.6	67
68	64·3	22·1	64·0	22.9	63·9	23·3	63·5	24·4	63 0	25.5	62·8	26.0	68
69	65·2	22·5	65.0	23·2	64 8	23.6	64·4	24.7	64.0	25.8	63.7	26.4	69
70	66.2	22.8	65.9	23·6	65.8	23·9	65·3	25·1	64.9	26.2	64·7	26.8	70
71	67·1	23.1	66.8	23.9	66·7	24.3	66·3	25·4	65.8	26·6	65·6	27·2	71
72	68·1	23·4	67.8	24.2	67.7	24.6	67 2	25·8	66.7	27.0	66.5	27·6	72
73	69.0	23·8	68.7	24.6	68.6	25.0	68.1	26·2	67.7	27·3	67·4	27·9	73
74	70.0	24·1	69.7	24.9	69·5	25 3	69.1	26·5	68.6	27·7	68.4	28·3	74
75	70 9	24·4	70 6	25·3	70·5	25.6	70.0	26.9	69·5	28 1	69·3	28.7	75
76	71·9	24.7	71.6	25·6	71·4	26.0	70·9	27.2	70·5	28·5	70·2	29.1	76
77	72.8	25 1	72 5	25·9	72·4	26.3	71·9	27.6	71·4	28·8	71.1	29·5	77
78	73·7	25·4	73·4	26.3	73·3	26·7	72 8	27.9	72·3	29.2	72·1	29.8	78
79	74 7	25·7	74·4	26.6	74 2	27.0	73·7	28.3	73.2	29.6	73.0	30 2	79
80	75·6	26.0	75.3	26.9	75.2	27.4	74 7	28·7	74.2	30·0	73·9	30.6	80
81	76.6	26.4	76.3	27·3	76.1	27.7	75.6	29.0	75·1	30.3	74.8	31.0	81
82	77·5	26.7	77.2	27.6	77·1	28.0	76·5	29.4	76.0	30·7	75·8	31·4	82
83	78.5	27.0	78.2	28.0	78.0	28 4	77·5	29.7	76·9	31 1	76.7	31·8	83
84	79.4	27.3	79·1	28·3	78.9	28.7	78·4	30.1	77 9	31.5	77.6	32 1	84
85	80·4	27·7	80·1	28.6	79·9	29 1	79·3	30·5	78.8	31 8	78.6	32·5	85
86	81·3	28·0	81.0	29.0	80 8	29·4	80·3	30.8	79.7	32.2	79·4	32·9	86
87	82.3	28·3	81·9	29.3	81.8	29.7	81·2	31.2	80.7	32.6	80 4	33·3	87
88	83·2	28.6	82.8	29.6	82.7	30·1	82.1	31·5	81.6	33 0	81·3	33·7	88
89	84·1	29.0	83.8	30.0	83.6	30 4	83 1	31·9	82.5	33·3	82.2	34.1	89
90	85 1	29·3	84.7	30·3	84 6	30·8	84.0	32·3	83 4	33.7	83·1	34·4	90
91	86 0	29.6	85·7	30.7	85·5	31·1	84·9	32.6	84·4	34 1	84·1	34.8	91
92	87.0	29·9	86 6	31·0	86·4	31·5	85·9	33·0	85·3	34·5	85.0	35·2	92
93	88 9	30.3	87·6	31.3	87·4	31·8	86.8	33·3	86.2	34 8	85 9	35.6	93
94	88·9	30.6	88·5	31·7	88·3	32 1	87.7	33.7	87 2	35·2	86.8	36 0	94
95	89·8	30·9	89·4	32·0	89·3	32.5	88.7	34.0	88·1	35.6	87.8	36·3	95
96	90·8	31·3	90 4	32·3	90.2	32·8	89·6	34·4	89.0	35·9	88·7	36 7	96
97	91 7	31.6	91·3	32.7	91·1	33·2	90·5	34.8	89.9	36.3	89.6	37 1	97
98	92.7	31·9	92.3	33·0	92·1	33·5	91 5	35·1	90·9	36·7	90·5	37·5	98
99	93.6	32.2	93·2	33·3	93·0	33·9	92.4	35·5	91·8	37·1	91·5	37 9	99
100	94·5	32.6	94·2	33·7	94.0	34·2	93·4	35 8	92·7	37·5	92·4	38·3	100
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	71 Deg.		6 ¼ Poin		70 Deg.		69 Deg.		68 Deg.		6 Points		

A Table of Difference

Diff.	23 Deg.		24 Deg.		25 Deg.		2 ¼ Point		26 Deg.		27 Deg.		Diff.
	Lat	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	00.9	00.4	1
2	01.8	00.8	01.8	00.8	01.8	00.8	01.8	00.9	01.8	00.9	01.8	00.9	2
3	02.8	01.2	02.7	01.2	02.7	01.3	02.7	01.3	02.7	01.3	02.7	01.4	3
4	03.7	01.6	03.6	01.6	03.6	01.7	03.6	01.7	03.6	01.7	03.6	01.8	4
5	04.6	01.9	04.6	02.0	04.5	02.1	04.5	02.1	04.5	02.2	04.5	02.3	5
6	05.5	02.3	05.5	02.4	05.5	02.5	05.4	02.6	05.4	02.6	05.3	02.7	6
7	06.4	02.7	06.4	02.8	06.4	03.0	06.3	03.0	06.3	03.1	06.2	03.2	7
8	07.4	03.1	07.3	03.2	07.3	03.4	07.2	03.4	07.2	03.5	07.1	03.6	8
9	08.3	03.5	08.2	03.7	08.2	03.8	08.1	03.8	08.1	03.9	08.0	04.1	9
10	09.2	03.9	09.1	04.1	09.1	04.2	09.0	04.3	09.0	04.4	08.9	04.5	10
11	10.1	04.3	10.0	04.5	10.0	04.6	09.9	04.7	09.9	04.8	09.8	05.0	11
12	11.0	04.7	11.0	04.9	10.9	05.1	10.8	05.1	10.8	05.3	10.7	05.4	12
13	12.0	05.1	11.9	05.3	11.8	05.5	11.7	05.6	11.7	05.7	11.6	05.8	13
14	12.9	05.5	12.8	05.7	12.7	05.9	12.7	05.9	12.6	06.1	12.5	06.4	14
15	13.8	05.9	13.7	06.1	13.6	06.3	13.6	06.4	13.5	06.6	13.4	06.8	15
16	14.7	06.2	14.6	06.5	14.5	06.8	14.5	06.8	14.4	07.0	14.3	07.3	16
17	15.6	06.6	15.5	06.9	15.4	07.2	15.4	07.3	15.3	07.4	15.1	07.7	17
18	16.6	07.0	16.4	07.3	16.3	07.6	16.3	07.7	16.2	07.9	16.0	08.2	18
19	17.5	07.4	17.4	07.7	17.2	08.0	17.2	08.1	17.1	08.3	16.9	08.6	19
20	18.4	07.8	18.3	08.1	18.1	08.4	18.1	08.5	18.0	08.8	17.8	09.1	20
21	19.3	08.2	19.2	08.5	19.0	08.9	19.0	09.0	18.9	09.2	18.7	09.5	21
22	20.2	08.6	20.1	09.6	19.9	09.3	19.9	09.4	19.8	09.9	19.6	10.0	22
23	21.2	09.0	21.0	09.3	20.8	09.7	20.8	09.8	20.7	10.1	20.5	10.4	23
24	22.1	09.4	21.9	09.8	21.7	10.1	21.7	10.3	21.6	10.5	21.4	10.9	24
25	23.0	09.8	22.8	10.2	22.7	10.6	22.6	10.7	22.5	11.0	22.3	11.3	25
26	23.9	10.2	23.7	10.6	23.6	11.0	23.5	11.1	23.4	11.4	23.2	11.8	26
27	24.8	10.5	24.7	11.0	24.5	11.4	24.4	11.5	24.3	11.8	24.1	12.3	27
28	25.8	10.9	25.6	11.4	25.4	11.8	25.3	12.0	25.2	12.3	24.9	12.7	28
29	26.7	11.3	26.5	11.8	26.3	12.3	26.2	12.4	26.1	12.7	25.8	13.2	29
30	27.6	11.7	27.4	12.2	27.2	12.7	27.1	12.8	27.0	13.1	26.7	13.6	30
31	28.5	12.1	28.3	12.6	28.1	13.1	28.0	13.3	27.9	13.6	27.6	14.1	31
32	29.5	12.5	29.2	13.0	29.0	13.5	28.9	13.7	28.8	14.0	28.5	14.5	32
33	30.4	12.9	30.1	13.4	29.9	13.9	29.8	14.1	29.6	14.4	29.4	15.0	33
34	31.3	13.3	31.1	13.8	30.8	14.4	30.7	14.5	30.6	14.9	30.3	15.4	34
35	32.2	13.7	32.0	14.2	31.7	14.8	31.6	15.0	31.5	15.3	31.2	15.9	35
36	33.1	14.1	32.9	14.6	32.6	15.2	32.5	15.4	32.4	15.8	32.1	16.3	36
37	34.1	14.4	33.8	15.0	33.5	15.6	33.4	15.8	33.2	16.2	33.0	16.8	37
38	35.0	14.8	34.7	15.4	34.4	16.0	34.3	16.2	34.1	16.6	33.9	17.2	38
39	35.9	15.2	35.6	15.9	35.3	16.5	35.3	16.7	35.0	17.1	34.7	17.7	39
40	36.8	15.6	36.5	16.3	36.2	16.9	36.2	17.1	35.9	17.5	35.6	18.2	40
41	37.7	16.0	37.5	16.7	37.2	17.3	37.1	17.5	36.8	18.0	36.5	18.6	41
42	38.7	16.4	38.4	17.1	38.1	17.7	38.0	18.0	37.7	18.4	37.4	19.1	42
43	39.6	16.8	39.3	17.5	39.0	18.2	38.9	18.4	38.6	18.8	38.3	19.5	43
44	40.5	17.2	40.2	17.9	39.9	18.6	39.8	18.8	39.5	19.3	39.2	20.0	44
45	41.4	17.6	41.1	18.3	40.8	19.0	40.7	19.2	40.4	19.7	40.1	20.4	45
46	42.3	18.0	42.0	18.0	41.7	19.4	41.6	19.7	41.3	20.2	41.0	20.9	46
47	43.3	18.4	42.9	19.1	42.6	19.9	42.5	20.1	42.2	20.6	41.9	21.3	47
48	44.2	18.8	43.8	19.5	43.5	20.3	43.4	20.5	43.1	21.0	42.8	21.8	48
49	45.1	19.2	44.8	19.9	44.4	20.7	44.3	20.9	44.0	21.5	43.7	22.1	49
50	46.0	19.5	45.7	20.3	45.3	21.1	45.2	21.4	44.9	21.9	44.5	22.7	50
Diff.	Dep	Lat	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	67 Deg.		66 Deg.		65 Deg.		5 ¼ Point		64 Deg.		36 Deg.		

Dif.	23 Deg.		24 Deg.		25 Deg.		2 ¼ Poin		26 Deg.		27 Deg.		Dif.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	46·9	19·9	46·6	20 7	46.2	21.8	46·1	21.8	45.8	22.3	45·4	23.2	51
52	47·9	20·3	47·5	21.1	47·1	22·0	47.0	22.2	46.7	22.8	46.3	23.6	52
53	48·8	20.7	48 4	21.5	48.0	22.4	47.9	22.7	47.6	23.2	47.2	24.1	53
54	49.7	21.1	49.3	22.0	48·9	22.8	48.8	23.1	48.5	23·7	48·1	24.5	54
55	50 6	21·5	50 2	22 4	49.8	23·2	49.7	23·5	49·4	24·1	49·0	25 0	55
56	51·5	21·9	51·2	22.8	50 6	23·7	50.6	23.9	50 3	24·5	49·9	25.4	56
57	52·5	22·3	52·1	23 2	51·7	24.1	51·5	24·4	51.2	25 0	50 8	25.9	57
58	53·4	22·7	53·0	23·6	52.6	24·5	52.4	24.8	52.1	25 4	51.7	26.3	58
59	54·3	23.0	53·9	24·0	53·5	24 9	53·3	25.2	53·0	25·9	52 6	26.8	59
60	55.2	23·4	54·8	24·4	54·4	25·4	54·2	25.6	53·9	26·3	53·5	27.2	60
61	56·1	23·8	55·7	24.8	55·3	25.8	55·1	26·1	54.8	26.7	54·4	27.7	61
62	57·1	24·2	56·6	25.2	56.2	26.2	56.0	26 5	55·7	27.2	55.2	28·1	62
63	58·0	24·6	57.5	25.6	57·1	26·6	56.9	26·9	56.6	27.6	56·1	28.6	63
64	58 9	25·0	58·5	26.0	58.0	27.0	57·9	27.4	57.5	28.0	57.0	29.1	64
65	59.8	25·4	59·4	26 4	58·9	27.5	58.8	27·8	58·4	28 5	57·9	29·5	65
66	60.7	25·8	60·3	26.8	59.8	27·9	59.7	28.2	59.3	28·9	58.8	30.0	66
67	61·7	26·2	61.2	27.2	60.7	28.3	60·6	28·6	60·2	29.4	59·7	30 4	67
68	62.6	26.6	62.1	27·7	61.6	28 7	61·5	29.1	61·1	29.8	60 6	30.9	68
69	63·5	27.0	63·0	28.1	62.5	29 2	62.4	29.5	62.0	30·2	61·5	31·3	69
70	64·4	27·3	63·9	28·5	63·4	29 6	63·3	29·9	62·9	30.7	62·4	31.8	70
71	65·4	27·7	64·9	28·9	64 3	30·0	64·2	30 4	63 8	31.1	63·3	32 2	71
72	66·3	28·1	65.8	29 3	65.2	30·4	65·1	30.8	64.7	31·6	64·2	32.7	72
73	67·2	28 5	66.7	29.7	66·2	30·8	66 0	31·2	65.6	32.0	65·0	33·1	73
74	68·1	28 9	67.6	30·1	67.1	31·3	66 9	31·6	66.5	32·4	65·9	33.6	74
75	69·0	29·3	68·5	30·5	68·0	31.7	67 8	32.1	67·4	32 9	66.8	34·1	75
76	70·0	29·7	69.4	30·9	68·9	32·1	68.7	32·5	68.3	33·3	67·7	34·5	76
77	70·9	30·1	70.3	31·3	69·8	32.5	69.6	32.9	69.2	33·7	68.6	35·0	77
78	71.8	30.5	71.2	31·7	70·7	33.0	70·5	33·3	70.1	34.2	69.5	35·4	78
79	72.7	30.9	72 2	32·1	71·6	33 4	71·4	33.8	71·0	34.6	70·4	35·9	79
80	73·6	31·3	73·1	32·5	72·5	33.8	72 3	34.2	71·9	35·1	71.3	36·3	80
81	74 6	31.6	74·0	32·9	73·4	34·2	73·2	34.6	72·8	35·5	72·2	36.8	81
82	75·5	32.0	74·9	33·3	74·3	34·7	74 1	35.1	73·7	35·0	73.1	37·2	82
83	76.4	32.4	75.8	33·8	75.2	35·1	75·0	35·5	74.6	36.4	74·0	37·7	83
84	77·3	32·8	76·7	34·2	76.1	35·5	75·9	35·9	75·5	36·8	74·8	38·1	84
85	78.2	33·2	77.6	34.6	77·0	35·9	76.8	36.3	76.4	37.3	75·7	38 6	85
86	79.2	33.6	78.6	35·0	77·9	36·3	77·7	36·8	77·3	37·7	76.6	39 0	86
87	80·1	34·0	79·5	35·4	78.8	36 8	78.6	37.2	78.2	38.1	77·5	39.5	87
88	81 0	34·4	80·4	35·8	79·7	37·2	79·5	37·6	79.1	38.6	78·4	40·0	88
89	81·9	34·8	81·3	36·2	80 7	37 6	80·5	38·1	80·0	39·0	79·3	40·4	89
90	82.8	35·2	82.2	36.6	81.6	38·0	81·4	38·5	80 9	39·4	80·2	40.9	90
91	83·7	35·6	83·1	37·0	82·5	38·5	82·3	38·9	81.8	39 8	81.1	41 3	91
92	84·7	35·9	84·0	37·4	83·4	38 9	83 2	39 3	82.7	40·3	82.0	41.8	92
93	85 6	36·3	85·0	37·8	84·3	39·3	84·1	39·8	83.6	40·8	82.9	42·2	93
94	86 5	36·7	85·9	38.2	85·2	39·7	85·0	40·2	84·5	41·2	83·8	42 7	94
95	87·4	37·1	86 8	38·6	86·1	40.1	85·9	40.6	85·4	41·6	84·6	43·1	95
96	88 4	37·5	87·7	39.0	87·0	40·6	86·8	41·0	86.3	42·1	85·5	43.6	96
97	89·3	37·9	88.6	39·4	87·9	41.0	87·7	41·5	87·2	42·5	86.4	44·0	97
98	90 2	38·3	89·5	39·9	88·8	41·4	88.6	41·9	88·1	43·0	87 3	44·5	98
99	91 1	38·7	90 4	40·3	89·7	41·8	89·5	42.3	89.0	43·4	88·2	44·9	99
100	92.0	39 1	91·4	40.7	90.6	42 3	90·4	42.7	89.9	43·8	89·1	45·4	100
Dif.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dif.
	67 Deg.		66 Deg.		65 Deg.		5 ¼ Poin		64 Deg.		63 Deg.		

A Table of Difference

Dist.	28 Deg.		2 ½ Poin		29 Deg.		30 Deg.		2 ¾ Poin		31 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.5	00.9	00.5	1
2	01.8	00.9	01.8	00.9	01.7	01.0	01.7	01.0	01.7	01 0	01.7	01.0	2
3	02.6	01 4	02.6	01.4	02.6	01.4	02.6	01 5	02.6	01.5	02.6	01.5	3
4	03.5	01.9	03.5	01.9	03.5	01.9	03.5	02.0	03.4	02.1	03.4	02.1	4
5	04.4	02.3	04.4	02.4	04.4	02.4	04.3	02.5	04.3	02.6	04.3	02 6	5
6	05.3	02.8	05.3	02.8	05.2	02.9	05.2	03.0	05.1	03.1	05.1	03.1	6
7	06.2	03.3	06.2	03.3	06.1	03.4	06 1	03.5	06.0	03.6	06.1	03.6	7
8	07.1	03.8	07.1	03.8	07°0	03.9	06.9	04.0	06.9	04.1	05.9	04 1	8
9	07.9	04.2	07.9	04.2	07.9	04.4	07.8	04.5	07.7	04.6	07 7	04 6	9
10	08.8	04.7	08.8	04.7	08.7	04.8	08 7	05.0	08.6	05 1	08.6	05.1	10
11	09.7	05.2	09.7	05 2	09.6	05.3	09.5	05.5	09.4	05.6	09.4	05.7	11
12	10.6	05.6	10.6	05 6	10.5	05.8	10.4	06.0	10.3	06.2	10.3	06.2	12
13	11.5	06.1	11.5	06.1	11.4	06 3	11.3	06 5	11.1	06.7	11.1	06.7	13
14	12.4	06.6	12.3	06.6	12.2	06.8	12 1	07.0	12.0	07.2	12.0	07.2	14
15	13.2	07.0	13.2	07.1	13.1	07.3	13.0	07.5	12 9	07 7	12.9	07.7	15
16	14.1	07.5	14.1	07.5	14.0	07.7	13.9	08.0	13.7	08.2	13.7	08 2	16
17	15.0	08.0	15.0	08.0	14.9	08.2	14.7	08.5	14 6	08.7	14 6	08 8	17
18	15.9	08.4	15.9	08.5	15.7	08.7	15.6	09.0	15 4	09.2	15.4	09.3	18
19	16.8	08.9	16.8	08.9	16.6	09.2	16.4	09.5	16.3	09.8	16.3	09 8	19
20	17 7	09.4	17.6	09.4	17.5	09.7	17.3	10.0	17.1	10.3	17.1	10.3	20
21	18.5	09.9	18.5	09 9	18.4	10.2	18.2	10.5	18.0	10.8	18.0	10.8	21
22	19.4	10.3	19.4	10.3	19.2	10.7	19.0	11.0	18.9	11.3	18.9	11.3	22
23	20.3	10 8	20 3	10.8	20.1	11.1	19.9	11.5	19.7	11 8	19.7	11.8	23
24	21.2	11.3	21.2	11.3	21.0	11.6	20.8	12.0	20.6	12 3	20 6	12.4	24
25	22.1	11.7	22 0	11 8	21.9	12.1	21.6	12 5	21.4	12.8	21.4	12.9	25
26	23.0	12.2	22.9	12.3	22.7	12.6	22.5	13.0	22.3	13.4	22.3	13.4	26
27	23.8	12.7	23.8	12.7	23.6	13.1	23.4	13.5	23.1	13.9	23.1	13.9	27
28	24.7	13.1	24.7	13.2	24.5	13.6	24.2	14.0	24.0	14.4	24.0	14.4	28
29	25.6	13.6	25.6	13.7	25.4	14.1	25.1	14.5	24.9	14.9	24.9	14.9	29
30	26.5	14.1	26.5	14.1	26.2	14 5	26.0	15.0	25.7	15.4	25.7	15.4	30
31	27.4	14.5	27.3	14.6	27.1	15.0	26.8	15.5	26.6	15.9	26.6	16.0	31
32	28.2	15.0	28.2	15.1	28 0	15.5	27.7	16.0	27.4	16.4	27.4	16.5	32
33	29.1	15.5	29.1	15.5	28.9	16.0	28.6	16.5	28.3	17.0	28.3	17.0	33
34	30.0	16.0	30.0	16.0	29.7	16.5	29.5	17.0	29 2	17.5	29.1	17.5	34
35	30.9	16.4	30 9	16.5	30.6	17.0	30.3	17.5	30.0	18.0	30.0	18.0	35
36	31.8	16.9	31.7	17.0	31.5	17.4	31.2	18.0	30.9	18.5	30.9	18.5	36
37	32.7	17.4	32.6	17.4	32.4	17.9	32.0	18.5	31.7	19.0	31.7	19.1	37
38	33.5	17.0	33.5	17.9	33 2	18.4	32.9	19.0	32.5	19.5	32.6	19.6	38
39	34.4	18.3	34.4	18.4	34.1	18.9	33.8	19.5	33.4	20 0	33.4	20.1	39
40	35 3	18.8	35.3	18.9	35.0	19.4	34.6	20.0	34.3	20.6	34.3	20.6	40
41	36.2	19 2	36.1	19.3	35.8	19.9	35.5	20.5	35.2	21.1	35.1	21.1	41
42	37.1	19.7	37.0	19.8	36.7	20.4	36.4	21.0	36.0	21.6	36.0	21.6	42
43	38.0	20.1	37.9	20.3	37.6	20.8	37.2	21.5	36.9	22.1	36.9	22.1	43
44	38.8	20.6	38.8	20.7	38.5	21.3	38.1	22.0	37.7	22.6	37.7	22.6	44
45	39.7	21.1	39.7	21.2	39.3	21.8	39.0	22.5	38.6	23.1	38.6	23.2	45
46	40.6	21.6	40.6	21.7	40.2	22.3	39.8	23.0	39.5	23.6	39.4	23.7	46
47	41.5	22.1	41.4	22.2	41.1	22.8	40.7	23.5	40 3	24.2	40.3	24.2	47
48	42.4	22.5	42.3	22.6	42.0	23.3	41.6	24.0	41.2	24.7	41.1	24.7	48
49	43.3	23.1	43.2	23.2	42.8	23.7	42.4	24.5	42 0	25.2	42 0	25.2	49
50	44.1	23 5	44.1	23.6	43.7	24.2	43.3	25.0	42.9	25.7	42.9	25.7	50
Dist.	Dep	Lat.	Dep	Lat	Dep	Lat.	De	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	62 Deg.		5 ½ Poin		61 Deg.		60 Deg.		5 ½ Poin		59 Deg.		

Dist.	28 Deg.		2 ½ Poin		29 Deg.		30 Deg.		2 ¾ Poin		31 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	45.0	23.9	45.0	24.0	44 6	24.7	44.2	25.5	43.7	26 2	43.7	26.3	51
52	45.9	24.4	45.9	24.5	45.5	25.2	45.0	26.0	44.6	26.7	44.6	26.8	52
53	46.8	24.9	46.7	25.0	46.3	25.7	45 9	26.5	45.4	27.2	45.4	27.3	53
54	47.7	25.3	47.6	25.5	47.2	26.2	46.8	27 0	46 3	27.8	46.3	27.8	54
55	48 6	25.8	48.5	25.9	48.1	26.7	47.6	27.5	47.2	28 3	47 1	28.3	55
56	49.4	26.3	49.4	26.4	49.0	27.1	48.5	28.0	48.0	28.8	48.0	28.8	56
57	50.3	26.8	50.3	26.9	49.8	27.6	49 4	28.5	48.9	29.3	48.9	29 4	57
58	51.2	27.2	51.2	27.3	50.7	28 1	50.2	29 0	49.7	29.8	49.7	29.9	58
59	52.1	27.7	52 0	27.8	51.6	28.6	51 1	29 5	50.6	30.3	50 6	30.4	59
60	53.0	28.2	52.9	28.3	52.5	29.1	52 0	30.0	51.5	30.8	51 4	30 9	60
61	53.9	28.6	53.8	28.7	53.3	29.6	52.8	30.5	52.3	31.4	52.3	31.4	61
62	54.7	29.1	54.7	29.2	54.2	30.1	53 7	31.0	53 2	31.9	53.1	31.9	62
63	55.6	29.6	55.6	29.7	55.1	30.5	54.6	31.5	54.0	32.4	54.0	32.4	63
64	56.5	30.0	56.4	30.2	56.0	31.0	55.4	32.0	54.9	32.9	54 9	33 0	64
65	57 4	30 5	57.3	30 5	56.8	31.5	56 3	32.5	55.7	33.4	55 7	33.5	65
66	58.3	31.0	58.2	31.1	57.7	32.0	57.2	33.0	56.6	33.9	56.6	34.0	66
67	59.2	31.4	59.1	31.6	58.6	32.5	58.0	33.5	57.5	34.4	57.4	34.5	67
68	60 0	31.9	60.0	32.0	59.5	33.0	58 9	34.0	58.3	35.0	58 3	35.0	68
69	60.9	32.4	60.8	32.5	60 3	33.4	59.7	34.5	59.2	35.5	59.1	35.5	69
70	61.8	32.9	61.7	33.0	61.2	33.9	60.6	35.0	60.0	36.0	60.0	36 0	70
71	62.7	33.3	62 6	33.5	62.1	34.4	61.5	35.5	60.9	36.5	60.9	36.6	71
72	63.6	33.8	63.5	33.9	63.0	34.9	62 3	36.0	61.8	37.0	61.7	37.1	72
73	64.4	34.3	64.4	34.4	63.8	35 4	63.2	36.5	62 6	37.5	62.6	37.6	73
74	65.3	34 7	65.3	34.9	64.7	35 9	64.1	37.0	63.5	38.0	63.4	38.1	74
75	66.2	35.2	66.1	35.4	65.6	36.4	64.9	37.5	64 3	38.6	64.3	38 6	75
76	67.1	35.7	67.0	35.8	66.5	36.8	65 8	38.0	65.2	39.1	65.1	39.1	76
77	68.0	36.1	67.9	36.3	67.3	37.3	66.7	38.5	66.0	39.6	66.0	39.7	77
78	68.9	36.6	68.8	36.8	68.2	37.8	67.5	39.0	66.9	40.1	66.9	40.2	78
79	69.7	37.1	69.7	37.2	69.1	38 3	68.4	39.5	67 8	40.6	67.7	40.7	79
80	70.6	37.6	70.5	37.7	70.0	38.8	69 3	40.0	68 6	41.1	68 6	41.2	80
81	71.5	38.0	71.4	38.2	70.8	39.3	70.1	40.5	69.3	41.6	69.4	41.7	81
82	72.4	38.5	72.3	38.6	71 7	39.7	70.9	41.0	70.3	42.2	70.3	42.2	82
83	73.3	39.0	73.2	39 1	72.6	40.2	71.9	41.5	71.2	42 7	71.1	42.7	83
84	74.2	39 4	74.1	39.6	73.5	40.7	72.7	42.0	72.1	43.2	72.0	43.3	84
85	75.0	39.9	75.0	40.1	74.3	41.2	73.6	42.5	72.9	43.7	72.9	43.8	85
86	75.9	40.4	75.8	40.5	75.2	41.7	74.5	43.0	73.8	44.2	73.7	44.3	86
87	76.8	40.8	76.7	41.0	76.1	42.2	75.3	43.5	74.6	44.7	74.6	44.8	87
88	77.7	41.3	77.6	41.5	77.0	42.7	76.2	44.0	75.5	45.2	75.4	45.3	88
89	78.6	41.8	78.5	41.9	77.8	43.1	77 1	44.5	76.3	45.8	76.3	45.8	89
90	79 5	42.2	79.4	42.4	78.7	43.6	77.9	45.0	77.2	46.3	77.1	46.3	90
91	80.3	42.7	80.2	42.9	79.6	44.1	78.8	45.5	78.1	46.8	78.0	46.9	91
92	81.2	43.2	81.1	43.4	80.5	44.6	79.7	46.0	78 9	47.3	78.9	47.4	92
93	82.1	43.6	82.0	43.8	81.3	45.1	80 5	46.5	79.8	47.8	79.7	47.9	93
94	83.0	44.1	82.9	44.3	82 2	45 6	81.4	47.0	80.6	48.3	80.6	48.4	94
95	83.9	44.6	83.8	44.8	83.1	46.1	82 3	47.5	81.5	48 8	81.4	48.9	95
96	84 8	45.1	84.7	45.2	84.0	46.5	83.1	48.0	82.3	49.3	82.3	49.4	96
97	85.6	45 5	85.5	45.7	84.8	47.0	84 0	48.5	83.2	49.9	83.1	50.0	97
98	86.5	46.0	86.4	46.2	85.7	47.5	84.9	49.0	84.1	50.4	84 0	50.5	98
99	87.4	46.5	87.3	46.7	86.6	48.0	85.7	49.5	84.9	50.9	84.9	51.0	99
100	88.3	46.9	88 2	47.1	87.5	48.5	86 6	50.0	85.8	51.4	85.7	51.5	100
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	62 Deg.		5 ½ Poin		61 Deg.		60 Deg.		5 ¼ Poin		59 Deg.		

Dif.	32 Deg.		33 Deg.		3 Points		34 Deg.		35 Deg.		36 Deg.		Dif.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.8	00.5	00.8	00.5	00.8	00 6	00.8	00.6	00.8	00.6	00.8	00.6	1
2	01.7	01.1	01.7	01.1	01.7	01.1	01.7	01.1	01.6	01 1	01.6	01.2	2
3	02.5	01.6	02.5	01.6	02.5	01 7	02.5	01.7	02.5	01.7	02.4	01.8	3
4	03.4	02.1	03 4	02.2	03.3	02.2	03.3	02.2	03.3	02.3	03.2	02.3	4
5	04.2	02.6	04.2	02.7	04.2	02.8	04.1	02.8	04.1	02.9	04.0	02.9	5
6	05.1	03.2	05.0	03.3	05.0	03.3	05.0	03.4	04.9	03.4	04.8	03.5	6
7	05.9	03.7	05.9	03.8	05.8	03.9	05.8	03.9	05.7	04.0	05.7	04.1	7
8	06.8	04.2	06.7	04.4	06.6	04.4	06.6	04.5	06.5	04.6	06.5	04 7	8
9	07.6	04.8	07.5	04.9	07.5	05.0	07.5	05.0	07.4	05 2	07 3	05.3	9
10	08.5	05.3	08.4	05.4	08.3	05.6	08 3	05.6	08.2	05.7	08.1	05.9	10
11	09 3	05.8	09.2	06.0	9.01	06.1	09.1	06.1	09.0	06.3	08.9	06.5	11
12	10.2	06.4	10.1	06.5	10.0	06.7	09.9	06 7	09.8	06.9	09.7	07.0	12
13	11 0	06.9	10.9	07.1	10.8	07.2	10.8	07.3	10.6	07.5	10.5	07.6	13
14	11.9	07.4	11.7	07.6	11.6	07.8	11.6	07.8	11.5	08.0	11.3	08 2	14
15	12.7	07.9	12.6	08.2	12.5	08.3	12.4	08.4	12.3	08.6	12.1	08 8	15
16	13.6	08.5	13.4	08.7	13.3	08.9	13.3	08.9	13 1	09.2	12.9	09.4	16
17	14.4	09.0	14.3	09.3	14.1	09.4	14.1	09.5	13.9	09.8	13.7	10.0	17
18	15.3	09.5	15.1	09 8	15.0	10.0	15.9	10.1	14.7	10.3	14.6	10.6	18
19	16.1	10.1	15.9	10.3	15.8	10.6	15.7	10.6	15 6	10.9	15.4	11.2	19
20	17 0	10.6	16.8	10.9	16.6	11.1	16.6	11.2	16.4	11.5	16 2	11.8	20
21	17.8	11.1	17.6	11.4	17.5	11.7	17.4	11.7	17.2	12.0	17.0	12.3	21
22	18 6	11.7	18.5	12.0	18.3	12.2	18.2	12.3	18.0	12.6	17.8	12.9	22
23	19.5	12.2	19.3	12.5	19.1	12.8	19.0	12 8	18 8	13.2	18.6	13.5	23
24	20.3	12.7	20 1	13.1	20.0	13.3	19.9	13.4	19.7	13.8	19.4	14.1	24
25	21.2	13.2	21.0	13.6	20.7	13.9	20.7	14.0	20.5	14.3	20 1	14.7	25
26	22.0	13.8	21.8	14.2	21.0	14.4	21.5	14.5	21.3	14.9	21 0	15.3	26
27	22.9	14.3	22.6	14.7	22 4	15.0	22.4	15.1	22.1	15 5	21.8	15.9	27
28	23.7	14.8	23.5	15.2	23.3	15.5	23.2	15 6	22.9	16.1	22 6	16.5	28
29	24.6	15.4	24.3	15.8	24.1	16.1	24.0	16.2	23.8	16.6	23.5	17.0	29
30	25.4	15.9	25.2	16.3	24.9	16.7	24.9	16.8	24.6	17.2	24.3	17.6	30
31	26.3	16.4	26.0	16.9	25.8	17.2	25.7	17.3	25.4	17.8	25.1	18 2	31
32	27.1	17.0	26.8	17.4	26.6	17.8	26.5	17.9	26.2	18.3	25.9	18.8	32
33	28.0	17.5	27 7	18.0	27.4	18.3	27.4	18 4	27.0	18.9	26.7	19.4	33
34	28.8	18 0	28.5	18.5	28 3	18.9	28.2	19.0	27.9	19 5	27.5	20.0	34
35	29.7	18.5	29.4	19.1	29.1	19.4	29.0	19.6	28.7	20 1	28.3	20.6	35
36	30.5	19 1	30.2	19.6	29.9	20.0	29.8	20.1	29 5	20.6	29.1	21.2	36
37	31.4	19.6	31 0	20.1	30.8	20.6	30.7	20.7	30.3	21.2	29.9	21.7	37
38	32.2	20.1	31.9	20.7	31.6	21.1	31.5	21.2	31.1	21.8	30 7	22.3	38
39	33.1	20.7	32.7	21.2	32 4	21.7	32.3	21.8	32.0	22.3	31.5	22.9	39
40	33.9	21.2	33.6	21.8	33 3	22.2	33.2	22.4	32 8	22.9	32 4	23.5	40
41	34 8	21.7	34.4	22.3	34.1	22.8	34.0	22.9	33.6	23.5	33.2	24 1	41
42	35 6	22.3	35.2	22.9	34.9	23.3	34.8	23.5	34.4	24.1	34 0	24 7	42
43	36.5	22.8	36.1	23.4	35.7	23.9	35.6	24.0	35.2	24.6	34.8	25.3	43
44	37.3	23.3	36.9	24.0	36.6	24.4	36 5	24.6	36.0	25.2	35.6	25.9	44
45	38 1	23.8	37.7	24 5	37.4	25 0	37.3	25.2	36.9	25.8	36.4	26.4	45
46	39.0	24.4	38.6	25.0	38.2	25.5	38.1	25.7	37.7	26.4	37.2	27.0	46
47	39.9	24.9	39.4	25.6	39.1	26.1	39.0	26 3	38.5	26.9	38.0	27.6	47
48	40.7	25.4	40.3	26.1	39.9	26.7	39.8	26.8	39.3	27.5	38.8	28 2	48
49	41.5	26 0	41.1	26.7	40.7	27.2	40.6	27.4	40 1	28.1	39.6	28 8	49
50	42.4	26.5	41.9	27.2	41.6	27.8	41.4	28 0	41.0	28.7	40.4	29.4	50
Dif.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dif.
	58 Deg.		57 Deg.		5 Points		56 Deg.		55 Deg.		54 Deg.		

Dist.	32 Deg.		33 Deg.		3 Points.		34 Deg.		35 Deg.		36 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	43.2	27.0	42.8	27.8	42.4	28 3	42.3	28.5	41.8	29.2	41.3	30 0	51
52	44.1	27.6	43.6	28.3	43.2	28.9	43.1	29.1	42.6	29.8	42.1	30.6	52
53	44.9	28.1	44.5	28.9	44.1	29.4	43.9	29.6	43.4	30.4	42.9	31.2	53
54	45.8	28.6	45.3	29.4	44.9	30.0	44 5	30.2	44.2	31 0	43.7	31.7	54
55	46.6	29.1	46 1	30.0	45.7	30.6	45.6	30.7	45.1	31.5	44.5	32.3	55
56	47.5	29.7	47.0	30.5	46.6	31.1	46.4	31.3	45.9	32.1	45.3	32.9	56
57	48.3	30.2	47.8	31.0	47.4	31.7	47.3	31.9	46.7	32.7	46.1	33.5	57
58	49.2	30.7	48 7	31.6	48.2	32 2	48.1	32.4	47.5	33.3	46.9	34.1	58
59	50 0	31.3	49.5	32.1	48.0	32.8	48.9	33.0	48.3	33.8	47.7	34.7	59
60	50.9	31.8	50 3	32.7	49.9	33.3	49.7	33.5	49.1	34.4	48.5	35 3	60
61	51.7	32.3	51.2	33.2	50 7	33.9	50.6	34.1	50 0	34.9	49.3	35.9	61
62	52 6	32.9	52.0	33.8	51 5	34.4	51.4	34.7	50.8	35.6	50 2	36.4	62
63	53.4	33.4	52.9	34.3	52.4	35.0	52.2	35.2	51.6	36.1	51.0	37.0	63
64	54.3	33.9	53.7	34.9	53 2	35.5	53.1	35 8	52.4	36.7	51.8	37.6	64
65	55.1	34 4	54.5	35.4	54.0	36 1	53.9	36.3	53.2	37.3	52 6	38.2	65
66	56.0	35.0	55.3	35.9	54.9	36.7	54.7	36.9	54.1	37.9	53.4	38.8	66
67	56.8	35.5	56.2	36.5	55.7	37.2	55.5	37.5	54 9	38 4	54 2	39.4	67
68	57.7	36.0	57.0	37.0	56.5	37.8	56.4	38.0	55.7	39 0	55.0	40.0	68
69	58.5	36.6	57.9	37.6	57.4	38.3	57.2	38.6	56.5	39.6	55.8	40.6	69
70	59.4	37.1	58 7	38.1	58.2	38.9	58.0	39.1	57.3	40.1	56.6	41.1	70
71	60.2	37.6	59.6	38.7	59.0	39.4	58.9	39 7	58.2	40.7	57.4	41.7	71
72	61.0	38.1	60.4	39.2	59.8	40.0	59.7	40.3	59.0	41.3	58.2	42.3	72
73	61.9	38.7	61.2	39.8	60.7	40.6	60.5	40.8	59.8	41.9	59.1	42.9	73
74	62.7	39.2	62.1	40.3	61.5	41.1	61.3	41.4	60.6	42.4	59.9	43.5	74
75	63.6	39.7	62.9	40.8	62.4	41.7	62.2	41.9	61.4	43.0	60.7	44.1	75
76	64.4	40.3	63.8	41.5	63.2	42.2	63.0	42.5	62.3	43.6	61.5	44.7	76
77	65.3	40.8	64.6	41.9	64.0	42 8	63.8	43.0	63 1	44.2	62.3	45.3	77
78	66.1	41.3	65.4	42.5	64.8	43.3	64.7	43.6	63.9	44.7	63.1	45.8	78
79	67.0	41.9	66.3	43.0	65.7	43.9	65.5	44.2	64.7	45.3	63.9	46.4	79
80	67.8	42.4	67.1	43.6	66.5	44.4	66.3	44.7	65.5	45.9	64.7	47.0	80
81	68.7	42.9	68 0	44.1	67.3	45 0	67 1	45.3	66.4	46 5	65.5	47.6	81
82	69.5	43.4	68.8	44 7	68.2	45.5	68.0	45.8	67.2	47.0	66.3	48.2	82
83	70.4	44.0	69.6	45 2	69.0	46.1	68.8	46.4	68.0	47.6	67.1	48.8	83
84	71.2	44.5	70 5	45 8	69.8	46.7	69.6	47.0	68.8	48.2	68.0	49.4	84
85	72.1	45.0	71.3	46.3	70.7	47.2	70.5	47.5	69.6	48.8	68.8	50.0	85
86	72 9	45.6	72 1	46.8	71.5	47.8	71.3	48.1	70.5	49.3	69.6	50.5	86
87	73.8	46.1	73.0	47.3	72.3	48.3	72.1	48.6	71.3	49.9	70.4	51.1	87
88	74 6	46.6	73.8	47.9	73.2	48.9	72.9	49.2	72.1	50.5	71.2	51.7	88
89	75.5	47.2	74.7	48.5	74.0	49.4	73.8	49 8	72.9	51.0	72.0	52.3	89
90	76.3	47.7	75.5	49.0	74.8	50.0	74 6	50.3	73.7	51 6	72.8	52.9	90
91	77.2	48.2	76.3	49.6	75.7	50.6	75.4	50.9	74.5	52.2	73.6	53.5	91
92	78.0	48.7	77.2	50.1	76.5	51.1	76.3	51 4	75.4	52.8	74.4	54.1	92
93	78.9	49.3	78.0	50.6	77.3	51.7	77.1	52.0	76.2	53.3	75.2	54.7	93
94	79.7	49.8	78.9	51.2	78.2	52.2	77.9	52.6	77 0	53.9	76.0	55.2	94
95	80.6	50.3	79.7	51.7	79.0	52.8	78.8	53.1	77.8	54.5	76.9	55.8	95
96	81.4	50 9	80.5	52.3	79.8	53 3	79.6	53.7	78.6	55 1	77.7	56.4	96
97	82.3	51.4	81.4	52.8	80 6	53.9	80.4	54.2	79.5	55 6	78.5	57.0	97
98	83.1	51.9	82.2	53.4	81.5	54.4	81.2	54.8	80.3	56.2	79.3	57.6	98
99	84.0	52.5	83.1	53.9	82.3	55.0	82.1	55 4	81.1	56.8	80 1	58.2	99
100	84.8	53.0	83.9	54 5	83.1	55.6	82.9	55 9	81.9	57.4	80 9	58.8	100
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	58 Deg.		57 Deg.		5 Points		56 Deg.		55 Deg.		54 Deg.		

Dist.	3 ¼ Point		37 Deg.		38 Deg.		39 Deg.		3 ½ Point		40 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.8	00.6	00.8	00.6	00.8	00 6	00 8	00.7	00.8	00.6	00.8	00.6	1
2	01.6	01.2	01 6	01.2	01.6	01.2	01.5	01.3	01.5	01 3	01.5	01.3	2
3	02.4	01.8	02.4	01.8	02.4	01.8	02.3	01.9	02.3	01.9	02.3	01.9	3
4	03.2	02.4	03 2	02.4	03.1	02.5	03.1	02.5	03.1	02.5	03.1	02.6	4
5	04.0	03.0	04.0	03 0	03.9	03.1	03 9	03.1	03 9	03.2	03 8	03.2	5
6	04.8	03.6	04.8	03.6	04.7	03.7	04.6	03.9	04.6	03.8	04.6	03.9	6
7	05.6	04.2	05.6	04 2	05.5	04.3	05.4	04.4	05.4	04.4	05.4	04 5	7
8	06.4	04 8	06.4	04.8	06.3	04.9	06.2	05.0	06.2	05.1	06.1	05.1	8
9	07.2	05.4	07.2	05 4	07.1	05.5	07.0	05.7	07.0	05.7	06.9	05 8	9
10	08.0	06.0	08.0	06 0	07.9	06 2	07.8	06.3	07.7	06.3	07.7	06.4	10
11	08.8	06.6	08.8	06.6	08.7	06.8	08 5	06.9	08.5	07.0	08.4	07.1	11
12	09 6	07.1	09 6	07.2	09.4	07.4	09.3	07.5	09.3	07.6	09.2	07.7	12
13	10.4	07.7	10.4	07.8	10.2	08.1	10.1	08.2	10.0	08.2	10.0	08 4	13
14	11.2	08.3	11.2	08.4	11.0	08.7	10.9	08.8	10.8	08.9	10.7	09.0	14
15	12.0	08.9	12.0	09.0	11 8	09.3	11.6	09.4	11.6	09.5	11.5	09 6	15
16	12.8	09.5	12 8	09 6	12.6	09.8	12.4	10.1	12.4	10.1	12.3	10.3	16
17	13.6	10.1	13.6	10.2	13.4	10.5	13.2	10.7	13.1	10.8	13.0	10.9	17
18	14.4	10.7	14.4	10.8	14.2	11.1	13.9	11.3	13.9	11.4	13 8	11.6	18
19	15.2	11.3	15.2	11.4	15.0	11.7	14.8	12.0	14.7	12 0	14.5	12.2	19
20	16.0	11.9	16.0	12.0	15.8	12.3	15.5	12.6	15.5	12.7	15.3	12.9	20
21	16.8	12.5	16.8	12.6	16.5	12.9	16.3	13 2	16.2	13.3	16 1	13.5	21
22	17 6	13.1	17.6	13.2	17.3	13.5	17.1	13 8	17.0	14.0	16.8	14.1	22
23	18.5	13.7	18.4	13.8	18.1	14.2	17.9	14.5	17.8	14.6	17.6	14.8	23
24	19.3	14.3	19.2	14.4	18.9	14 8	18.6	15.1	18.5	15.2	18.4	15.4	24
25	20.1	14.9	20 0	15.0	19.7	15.4	19.4	15.7	19.3	15.9	19.1	16.1	25
26	20.9	15.5	20 8	15.6	20.5	16.0	20.2	16.4	20.1	16.5	19.9	16.7	26
27	21.7	16 1	21.6	16.2	21.3	16.6	21.0	17.0	20.9	17.1	20 7	17.4	27
28	22.5	16.7	22.4	16.8	22.1	17.2	21.8	17.6	21.6	17.8	21.4	18.0	28
29	23.3	17.3	23.2	17.4	22.8	17.8	22.1	18.3	22.4	18.4	22.2	18.6	29
30	24.1	17.9	24.0	18.0	23.6	18.5	23.3	18.9	23.2	19.0	23.0	19.3	30
31	24 9	18 5	24.8	18.6	24.4	19.1	24.1	19.5	24.0	19.7	23.7	19.9	31
32	25.7	19 1	25.6	19.3	25.2	19.7	24 9	20.1	24.7	20 3	24.5	20.6	32
33	26.5	19.7	26.4	19 9	26.0	20.3	25.6	20 8	25.5	20.9	25.3	21.2	33
34	27.3	20.2	27 1	20.5	26.8	20.9	26.4	21.4	26.3	21.6	26.0	21.9	34
35	28.1	20.8	27.9	21.1	27.6	21.5	27.2	22.0	27.0	22.2	26.8	22.5	35
36	28.9	21.4	28 7	21.7	28 4	22.2	27.7	22.7	27.8	22.8	27.6	23.1	36
37	29.7	22.0	29.5	22 3	29.2	22.8	28.8	23.3	28.6	23.5	28.3	23.8	37
38	30.5	22.6	30.3	22.9	29.9	23.4	29.5	23.9	29 4	24.1	29.1	24 4	38
39	31.3	23.2	31.1	23.5	30.7	24.0	30.3	24.5	30.1	24.7	29.9	25.1	39
40	32.1	23.8	31.9	24.1	31.5	24.6	31.1	25.2	30.9	25.4	30.6	25.7	40
41	32.9	24.4	32.7	24.7	32.3	25.2	31.9	25.8	31.7	26.0	31.4	26.4	41
42	33.7	25.0	33.5	25.3	33 1	25.9	32.6	26.4	32.5	26.6	32.2	27.0	42
43	34.5	25.6	34.3	25.9	33.9	26.5	33.4	27.1	33.2	27.3	32.9	27.6	43
44	35.3	26.2	35.1	26.5	34.7	27.1	34.2	27.7	34 0	27.9	33.7	28 3	44
45	36.1	26 8	35.9	27.1	35.5	27.7	35 0	28.3	34.8	28.5	34 5	28.9	45
46	36.9	27.4	36.7	27.7	36.2	28.3	35.7	29.0	35.6	29.2	35.2	29.6	46
47	37 7	28.0	37.5	28.3	37.0	28 9	36.5	29 6	36.3	29.8	36.0	30.2	47
48	38.5	28.6	38.3	28.9	37.8	29.5	37.8	30.2	37.1	30.4	36.8	30 9	48
49	39.3	29.2	39.1	29 5	38.6	30.2	38.1	30.8	37.9	31.1	37.5	31.5	49
50	40 2	29.8	39.9	30.1	39.4	30.8	38.9	31.5	38.6	31.7	38.3	32.1	50
Dist.	Dep	Lat.	Dep	Lat	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	4 ¾ Point		53 Deg.		52 Deg.		51 Deg.		4 ½ Point		50 Deg.		

Dist.	3 ¼ Poin		37 Deg.		38 Deg.		39 Deg.		3 ½ Poin		40 Deg.		Dist.
	Lat.	Dep	Lat.	Dep	Lat	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	41.0	30.4	40.7	30.7	40.2	31.4	39.6	32.1	39.4	32.3	39 1	32.8	51
52	41.8	31.0	41.5	31.3	41.0	32.0	40.4	32.7	40.2	33.0	39.8	33.4	52
53	42.6	31.6	42.3	31.9	41.8	32.6	41.2	33.3	41 0	33.6	40 6	34.1	53
54	43.4	32.2	43.1	32.5	42.5	33.2	42.0	34.0	41.7	34.3	41.4	34.7	54
55	44.2	32.8	43.9	33.1	43.3	33.9	42.7	34.6	42.5	34.9	42.1	35.4	55
56	45.0	33.3	44.7	33.8	44.1	34.5	43.5	35.2	43.3	35.5	42.9	36 0	56
57	45.8	33.9	45.5	34.3	44.9	35.1	44 3	35 9	44.1	36.2	43.7	36.6	57
58	46.6	34.5	46 3	34.9	45.7	35.8	45.1	36.5	44.8	36.8	44.4	37.3	58
59	47.4	35.1	47.1	35.5	46.5	36 3	45.8	37.1	45.6	37.4	45.2	37 9	59
60	48.2	35.7	47.9	36.1	47.3	36.9	46.6	37.8	46.4	38.1	46.0	38.6	60
61	49.0	36.3	48.7	36.7	48.1	37.5	47.4	38.4	47.1	38.7	46.7	39.2	61
62	49 8	36.9	49.5	37.3	48.9	38.2	48.2	39.0	47.9	39.3	47.5	39.9	62
63	50 6	37.5	50.3	37.9	49.6	38.8	49.0	39 6	48.7	40.0	48.3	40.5	63
64	51.4	38.1	51.1	38.4	50 4	39.4	49.7	40.3	49.5	40.6	49 0	41.2	64
65	52.2	39.7	51.8	39.1	51 2	40.0	50.5	40.9	50 2	41.2	49.8	41.8	65
66	53.0	39.3	52.7	39.7	52.0	40.6	51.3	41.5	51.0	41.9	50 5	42 4	66
67	53.8	39.9	53.5	40.3	52.8	41.2	52.1	42.2	51.8	42.5	51.3	43.1	67
68	54.6	40.5	54.3	40.9	53.6	41.9	52.8	42.8	52.6	43.1	52 1	43.7	68
69	55.4	41.1	55.1	41 5	54.4	42 5	53.6	43.4	53.3	43.8	52.9	44.4	69
70	56.2	41.7	55.9	42.1	55.2	43.1	54.4	44.0	54.1	44.4	53.6	45.0	70
71	57.0	42.3	56.7	42.7	55.9	43.7	55.2	44.7	54 9	45.0	54 4	45.6	71
72	57.8	42.9	57.5	43.0	56.7	44.3	55.9	45.3	55.7	45 7	55.1	46.3	72
73	58.6	43.5	58.3	43.9	57.5	44.9	56.7	45.9	56.4	46 3	55.9	46.9	73
74	59.4	44.1	59.1	44.5	58.3	45 6	57 5	46 6	57.2	46.9	56.7	47.6	74
75	60.2	44.7	59.9	45 1	59.2	46.2	58.3	47.2	58.0	47.6	57.4	48.2	75
76	61.0	45.3	60.7	45.7	60.0	46.8	59.1	47 8	58.7	48.2	58.2	48.9	76
77	61.8	45.9	61.5	46 3	60.7	47.4	59.8	48.5	59.5	48.8	59.0	49.5	77
78	62.7	46.5	62.3	46.9	61.5	48.0	60.6	49.1	60 3	49.5	59.7	50.1	78
79	63.5	47.1	63.1	47 5	62.2	48.6	61.4	49 7	61.1	50.1	60.5	50.8	79
80	64.3	47.7	63.9	48.1	63.0	49.3	62.2	50.3	61.8	50.7	61.3	51.4	80
81	65.1	48.3	64.7	48.7	63 8	49.9	62 9	51.0	62.6	51.4	62 0	52.1	81
82	65 9	48.8	65.5	49.3	64.6	50.5	63.7	51.6	63.4	52.0	62.8	52.7	82
83	66.7	49.4	66.3	49.9	65.4	51.1	64.5	52.2	64.2	52.6	63.6	53.4	83
84	67.5	50 0	67.1	50.5	66.2	51.7	65.2	52.9	64.9	53.3	64.3	54 0	84
85	68.3	50 6	67.9	51.1	67.0	52.3	66.1	53.5	65.7	53 9	65 1	54.6	85
86	69.1	51.2	68.7	51.7	67.8	52.9	66.8	54.1	66.5	54.6	65.9	55 3	86
87	69 9	51.8	69.5	52.4	68.6	53 6	67 6	54.8	67.2	55 2	66.6	55.9	87
88	70.7	52.4	70.3	53.0	69.3	54.2	68.4	55.4	63.0	55.8	67.4	56.6	88
89	71.5	53 0	71.1	53.6	70.1	54.8	69.2	56.0	68.8	56.5	68.2	57.2	89
90	72.3	53.6	71.9	54.2	70.9	55.4	69.9	56 6	69.6	57.1	68.9	57.4	90
91	73.1	54.2	72 7	54.8	71.7	56.0	70.7	57.3	70.3	57 7	69.7	58.5	91
92	73 9	54.8	73.5	55.4	72.5	56 6	71.5	57.9	71.1	58.4	70.5	59.1	92
93	74 7	55.4	74.3	56.0	73.3	57.3	72.3	58.5	71.9	59.0	71.2	59.8	93
94	75.5	56.0	75.1	56.6	74.1	57.9	73.0	59.2	72.7	59 6	72.0	60.4	94
95	76.3	56.6	75.9	57.2	74.9	58 5	73.	59.8	73.4	60.3	72.8	61.1	95
96	77.1	57.2	76.7	57.8	75.6	59.1	74 6	60 4	74.2	60.9	73.5	61.7	96
97	77.9	57.8	77.5	58.4	76.4	59.7	75.4	61.0	75.0	61.5	74.3	62 1	97
98	78.7	58.4	78.3	59 0	77.2	60.3	76.2	61.7	75.7	62.2	75.2	63.0	98
99	79.5	59.0	79.1	59.6	78.0	60 9	76.9	62.3	76.5	62.8	75 8	63.6	99
100	80.3	59.6	79.9	60.2	78.8	61.6	77.7	62.9	77.3	63.4	76.6	64.3	100
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	4 ¾ Poin		53 Deg.		52 Deg.		51 Deg.		4 ½ Poin		50 Deg.		

A Table of Difference

Dist.	41 Deg.		42 Deg.		3 ¼ Point		43 Deg.		44 Deg.		4 Points		Dist.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
1	00.7	00.7	00.7	00.7	00.7	00.7	00 7	00.7	00.7	00.7	00.7	00.7	1
2	01.5	01 3	01 5	01.3	01.5	01.3	01.5	01.4	01.4	01 4	01.4	01.4	2
3	02.3	02.0	02.2	02.0	02.2	02.0	02.2	02.0	02.2	02.1	02.1	02.1	3
4	03.0	02 6	03 0	02.7	03.0	02.7	02 9	02.7	02.9	02.8	02 8	02 8	4
5	03.8	03.3	03.7	03 3	03.7	03.4	03.6	03.4	03.6	03.5	03.5	03.5	5
6	04.5	03.9	04.5	04 0	04.4	04.0	04.4	04.1	04.3	04.2	04.2	04 2	6
7	05.3	04.6	05.2	04.7	05 2	04.7	05 1	04.8	05.0	04.9	04.9	04 9	7
8	06.0	05.2	05.9	05 3	05 9	05.4	05.8	05.5	05.7	05.6	05.7	05.7	8
9	06.8	05.9	06.7	06.0	06.7	06.0	06 6	06.1	06.5	06.2	06.4	06.4	9
10	07.5	06.6	07.4	06.7	07.4	06.7	07.3	06.8	07.2	06.9	07 1	07.1	10
11	08.3	07.2	08 2	07.4	08.1	07.4	08 0	07.5	07.9	07.6	07.8	07.8	11
12	09 1	07.9	08.9	08.0	08.9	08.1	08.8	08.2	08.6	08.3	08.5	08 5	12
13	09.8	08.5	09 7	08.7	09.6	08.7	09.5	08.9	09.3	09.0	09.2	09.2	13
14	10 6	09.2	10.4	09.4	10 4	09.4	10.2	09.5	10.1	09.7	09.9	09 9	14
15	11.3	09.8	11.1	10.0	11.1	10.1	11.0	10.2	10.8	10.4	10.6	10.6	15
16	12.1	10.5	11.9	10.7	11 9	10.7	11.7	10.9	11 5	11.1	11.3	11.3	16
17	12.8	11.1	12.6	11.4	12.6	11.4	12.4	11 6	12.3	11 8	12.0	12.0	17
18	13.6	11.8	13.4	12.0	13.3	12.1	13.2	12.3	12.9	12 5	12.7	12.7	18
19	14.3	12.5	14.1	12.7	14.1	12.8	13.9	13.0	13.7	13.2	13.4	13.4	19
20	15.1	13.1	14.9	13.4	14.8	13.4	14.6	13.6	14.4	13.9	14 1	14.1	20
21	15 8	13.8	15.6	14 0	15 6	14.1	15.4	14.3	15 1	14.6	14 8	14.8	21
22	16.6	14.4	16.3	14.7	16.3	14 8	16.1	15.0	15.8	15.3	15.5	15.5	22
23	17 4	15.1	17.1	15.4	17.0	15.4	16.8	15 7	16.5	16.0	16.3	16.3	23
24	18.1	15.7	17.8	16.1	17.8	16.1	17.5	16.4	17.3	16.7	17.0	17 0	24
25	18.9	16.4	18.6	16.7	18 5	16.8	18.3	17.1	18.0	17.4	17.7	17.7	25
26	19.6	17.1	19.3	17.5	19.3	17.4	19.0	17.7	18.7	18.1	18.4	18.4	26
27	20.4	17.7	20 1	18.1	20.0	18.1	19.7	18.4	19.4	18.8	19.1	19.1	27
28	21.1	18.4	20 8	18.7	20.7	18.8	20.5	19.1	20.1	19.4	19.8	19.8	28
29	21.9	19.0	21.5	19.4	21.5	19.5	21.2	19.1	20.9	20 8	20.5	20.5	29
30	22.6	19.7	22.3	20.1	22.2	20.1	21.9	20.5	21.6	20.8	21.2	21.2	30
31	23.4	20.3	23.0	20.7	23.0	20.8	22.6	21.1	22.3	21.5	21.9	21.9	31
32	24.1	21.0	23.8	21.4	23.7	21.5	23.4	21.8	23.0	22.2	22.6	22.6	32
33	24 9	21.6	24.5	22.1	24.4	22.2	24.1	22.5	23.7	22.9	23.3	23.3	33
34	25.6	22.3	25.3	22.7	25.2	22.8	24 9	23.2	24.5	23.6	24.0	24 0	34
35	26.4	23.0	26.0	23.4	25.9	23.5	25.6	23.9	25.2	24.3	24.7	24.7	35
36	27.2	23.6	26.7	24.1	26.7	24.2	26.3	24.5	25.9	25.0	25.4	25.4	36
37	27.9	24.3	27.5	24.7	27.4	24.8	27.0	25.2	26.6	25.7	26.1	26.1	37
38	28.7	24.9	28 2	25.4	28 2	25.5	27.8	25.9	27.3	26.4	26.9	26.9	38
39	29.4	25.6	29.0	26.1	28.9	26.2	28.5	26.6	28.0	27 1	27.6	27.6	39
40	30.2	26.2	29.7	26.8	29.6	26.9	29.2	27.3	28.8	27.8	28.3	28 3	40
41	31.0	26.9	30.5	27.4	30.4	27.5	30.0	28.0	29.5	28.5	29.0	29.0	41
42	31.7	27.5	31.2	28.1	31.1	28.2	30.7	28 6	30.2	29.2	29.7	29.7	42
43	32.5	28.2	31.9	28.8	31.9	28.9	31.4	29.3	30.9	29.9	30.4	30.4	43
44	33.2	28.9	32.7	29 4	32 6	29.5	32.2	30.0	31.6	30.6	31.1	31.1	44
45	34.0	29.5	33.4	30.1	33 3	30.2	32.9	30.7	32.4	31.3	31.8	31.8	45
46	34.7	30.2	34.2	30 8	34.1	30.9	33.6	31.4	33.1	32.0	32.5	32.5	46
47	35.5	30.8	34.9	31.4	34.8	31.6	34.4	32.1	33.8	32.6	33.2	33.2	47
48	36.3	31.5	35.7	32.1	35.6	32.2	35.1	32.7	34 5	33.3	33.9	33.9	48
49	37.0	32.1	36.4	32.8	36.3	32.9	35.8	33.4	35.2	34.0	34 6	34.6	49
50	37 7	32.8	37.2	33.5	37.0	33.6	36.6	34.1	36.0	34.7	35.3	35.3	50
Dist.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dist.
	49 Deg.		48 Deg.		4 ¼ Point		47 Deg.		46 Deg.		4 Points		

Diff.	41 Deg.		42 Deg.		3 ½ Point		43 Deg.		44 Deg.		4 Points		Diff.
	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	
51	38.5	33 5	37.9	34.1	37.8	34.2	37.3	34.8	36.7	35.4	36 1	36 1	51
52	39.2	34.1	38.6	34.8	38.5	34.9	38.0	35.5	37.4	36.1	36.8	36.8	52
53	40.0	34 8	39.4	35.5	39.3	35 6	38.8	36.1	38 1	36 8	37 5	37 5	53
54	40.8	35.4	40.1	36.1	40.0	36.3	39.5	36.8	38 8	37.5	38.2	38.2	54
55	41.5	36.0	40 9	36.8	40 7	36.9	40.2	37.5	39.6	38.2	38 9	38 9	55
56	42.3	36.7	41 6	37.5	41.5	37.6	41.0	38.2	40.3	38.9	39 6	39.6	56
57	43.0	37.4	42.4	38.1	42.2	38.3	41.7	38.9	41.0	39.6	40 3	40.3	57
58	43 8	38.1	43.1	38.8	43.0	38.9	42 4	39.5	41.7	40.3	41.0	41.0	58
59	45.5	38.7	43.8	39 5	43.7	39.6	43.1	40.2	42.4	41.0	41.7	41.7	59
60	45.3	39.4	44 6	40.1	44.5	40.3	43 8	40.9	43.2	41.7	42.4	42.4	60
61	46.0	40 0	45.3	40.8	45.2	41.0	44.6	41.7	43.9	42.4	43.1	43.1	61
62	46 8	40.7	46 1	41.5	45.9	41.6	45.3	42 3	44.6	43.1	43.8	43 8	62
63	47.6	41.3	46.8	42.2	46.7	42.3	46.1	43.0	45.3	43.8	44.5	44.5	63
64	48.3	42.0	47.5	42.8	47.4	43.0	46 8	43.6	46 0	44.5	45.3	45.3	64
65	49.1	42.6	48.3	43.5	48.2	43.6	47.5	44.3	46 8	45.1	46.0	46.0	65
66	49.8	43.3	49.0	44.2	48.9	44 3	48.3	45.0	47.5	45.8	46.7	45.7	66
67	50.6	44.0	49.8	44.8	49 6	45.0	49 0	45.7	48.2	46.5	47.4	47.4	67
68	51.3	44.6	50.5	45.5	50.4	45 7	49.7	46.4	48.9	47.2	48.1	48.1	68
69	52.1	45.3	51.3	46.2	51.1	46.3	50.5	47.1	49.6	47.9	48.8	48.8	69
70	52.8	45 9	52 0	46.8	51 9	47.0	51 2	47.7	50.3	48.6	49.5	49.5	70
71	53.6	46.6	52.8	47.5	52.6	47.7	51.9	48.4	51.1	49.3	50.2	50.2	71
72	54.3	47.2	53.5	48 2	53.3	48.3	52 7	49.1	51.8	50.0	50.9	50.9	72
73	55.1	47.9	54.2	48 8	54.1	49.0	53.4	49.8	52.5	50.7	51.6	51.6	73
74	55.9	48.5	55.0	49.5	54 8	49.7	54.1	50.5	53.2	51.4	52.3	52.3	74
75	56.6	49.2	55.7	50.2	55.6	50.4	54.8	51.1	53 9	52.1	53.0	53.0	75
76	57 4	49.9	56.5	50.9	56.3	51.0	55.6	51.8	54.7	52.8	53.7	53.7	76
77	58.1	50 5	57.2	51.5	57 1	51 7	56 3	52 5	55.4	53.5	54.4	54.4	77
78	58.9	51.2	58.0	52.1	57.8	52.4	57.0	53.2	56.1	54 2	55 2	55.2	78
79	59.6	51.8	58.7	52.8	58.5	53.0	57.8	53.9	56 8	54.9	55.9	55.9	79
80	60 4	52.5	59.4	53.5	59.3	53.7	58 5	54.6	57.5	55.6	56.6	56.6	80
81	61.1	53.1	60.2	54.2	60.0	54.4	59.2	55.2	58.3	56.3	57.3	57 3	81
82	61.9	53.8	60.9	54.9	60.8	55.1	60.0	55.9	59.0	57.0	58 0	58.0	82
83	62.6	54.5	61.7	55.5	61.5	55.7	60.7	56.6	59.7	57 6	58.7	58.7	83
84	63.4	55.1	62.4	56.2	62.2	56.4	61.4	57.3	60.4	58 3	59.4	59.4	84
85	64.2	55.9	63.2	56.9	63.0	57.1	62 2	58.0	61.1	59 0	60.1	60.1	85
86	64.9	56.4	63.9	57.5	63.7	57.7	63.0	58 6	61.9	59.7	60.8	60.8	86
87	65.7	57.1	64.7	58.2	64.5	58.4	63.6	59.3	62 6	60.4	61.5	61.5	87
88	66.4	57.7	65.4	58.9	65.2	59.1	64.4	60 0	63.3	61.1	62.2	62.2	88
89	67.2	58.4	66.1	59.6	65.9	59.8	65.1	60.7	64 0	61.8	62.9	62.9	89
90	67.9	59.0	66.9	60 2	66.7	60.4	65.8	61.4	64.7	62 5	63.6	63.6	90
91	68.7	59.7	67.6	60.9	67.4	61.1	66.5	62 1	65.5	63.2	64.3	64.3	91
92	69.4	60.4	68.4	61.6	68.2	61.8	67.3	62.7	66.2	63.9	65.0	65 0	92
93	70.2	61.0	69.1	62.2	68.9	62 4	68.0	63.4	66.9	64.6	65.8	65.8	93
94	71.0	61.7	69.9	62.9	69 6	63.1	68 7	64.1	67.6	65.3	66.5	66.5	44
95	71.7	62.3	70.6	63.6	70.4	63.8	69.5	64.8	68 3	66.0	67.2	67.2	95
96	72.5	63.0	71.3	64.2	71.1	64.5	70.2	65.5	69.1	66.7	67.9	67.9	96
97	73.2	63.6	72.1	64.9	71.9	65.1	70.9	66.1	69.8	67 4	68 6	68 6	97
98	74.0	64.3	72.8	65.6	72.6	65.8	71.7	66.8	70.5	68 1	69.3	69.3	98
99	74.7	65.0	73.6	66.2	73.4	66.5	72.4	67.5	71.2	68.8	70 0	70.0	99
100	75.5	65.6	74.3	66 9	74.1	67.2	73.1	68.2	71 9	69.5	70.7	70.7	100
Diff.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Dep	Lat.	Diff.
	49 Deg.		48 Deg.		4 ½ Point		47 Deg.		46 Deg.		4 Points		

The Use and Explanation of the Table of Difference of Latitude and Departure.

THis is a Table larger and better contrived than any of this Nature yet extant, giving the Difference of Latitude and Departure, to any distance not exceeding 100, in Minutes and Tenth-Parts, to every Degree and Quarter-Point of the Comqass; and may be used to a greater distance, being taken out at twice or thrice according to the quantity of the distance, as shall be shown in the Use.

The Course stands at the head and foot of the Table, to every Degree and Quarter-Point of the Compass; at the head it begins at 1 deg. so 2 Deg. $\frac{1}{4}$ Point, *&c.* increasing to 45 Deg. or 4 Points. At the foot it begins at 45 Deg. or 4 Points, so 46 Deg. 47 Deg. 4 $\frac{1}{4}$ Points, *&c.* increasing backwards to 90 Deg. or 8 Points. The Distance stands in the two outmost Columns, under the Title *Distance*, which on the left-hand Page begins at 1, and runs to 50; on the right-hand Page it begins at 51, and runs to 100. The Difference of Latitude and Departure stands under the Course at the head, and over it at the foot of the Table.

The Use of the Table.

This Table is very useful in Navigation, especially in working a *Traverse*.

Example 1.

The Course and Distance given, to find the Difference of Latitude and Departure by the Table.

Suppose a Ship sail N. N. E. $\frac{1}{4}$ East, 95 min. and the Difference of Latitude and Departure required.

On the right hand Page (because the distance is above 50) and at the top (because it is under 4 Points) look for 2 $\frac{1}{4}$ Points, which is the Course; under which, and against 95 the distance, under the Title *Lat.* stands 81. 5. which is 81 min. the $\frac{5}{10}$ the Difference of Latitude; and under the Title *Dep.* stands 48.8. that is 48 min. $\frac{8}{10}$ which is the Departure required.

Example 2.

Suppose a Ship sail South 56°, Westerly 48 min. the Difference of Latitude and Departure required.

On

On the left-hand Page, (becauſe the Diſtance is leſs than 50) and at the bottom (becauſe it is above 45 deg.) look for 56 deg. the Courſe; over which, and againſt 48 the diſtance, over the Title *Lat.* ſtands 26.8 that is 26 min. $\frac{8}{10}$ the Difference of Latitude; and over the Title *Dep.* ſtands 39.8. that is 39 min. $\frac{8}{10}$, the Departure required.

Example 3.

Suppoſe a Ship ſail North-Weſt by North 160 min. and the Difference of Latitude and Departure required by the Table.

On the right-hand Page at the top, look for 3 Points the Courſe. Now becauſe the Table goes but to 100, take for 100 firſt; therefore under 3 Points, and againſt 100, under the Title *Lat.* ſtands 83. 1. that is, 83 min. $\frac{1}{10}$. the Difference of Latitude; and under the Title *Dep.* ſtands 55.6. that is, 55 min. $\frac{6}{10}$ the Departure; then for 60, under 3 Points, and againſt 60, under the Title *Lat.* ſtands 49.9. that is 49 min. $\frac{9}{10}$ the Difference of Latitude; and under the Title *Dep.* ſtands 33.3. that is 33 min. $\frac{3}{10}$ the Departure; then add the Difference of Latitude and Departure for 60, to the Difference of Latitude and Departure for 100, and the Sum is 133 the Difference of Latitude, and 88 $\frac{9}{10}$ the Departure required.

This Table is alſo uſeful in the reſolution of the reſt of the Problems of *Plain Sailing*, which for brevities ſake are omitted; but the general uſe of it is in the exact working of a Traverſe.

Example 1.

Suppoſe a Ship bound to a certain Port ſails S. E. by South, 49 min. then E.S.E. $\frac{1}{2}$ Eaſt. 52 min. then Eaſt by North $\frac{1}{2}$ Eaſt, 62 min. then S. S.W. $\frac{1}{2}$ Weſt, 57 min. then South $\frac{1}{2}$ Eaſt 39 min. to find the Difference of Latitude and Departure that the Ship hath made.

Set down the ſeveral Courſes and Diſtances; firſt allowing for Leeway, if any; then proceed to look out the Difference of Latitude and Departure for each Courſe and Diſtance (by the directions before given) in the Table, placing them in their proper Columns, (*viz.*) If the Courſe be Northerly, the Difference of Latitude muſt be put in the North Column; if Southerly, in the South Column; if it be Eaſterly, the Departure muſt be put in the Eaſt Column; if Weſterly, in the Weſt Column, as was before directed: Then having framed the Table, add up the Columns of Difference of Latitude and Departure, and ſubtract the leſſer Difference of Latitude and Departure from the greater, and the Remainder is the whole Difference of Latitude and Departure the Ship hath made.

The Table.

Courses.	Dist.	Diff. Lat. Nor.	Diff. Lat. Sou.	Departure. East.	Departure. West.
S. E. by S.	49		40. 7	27. 2	
E. S. E. ½ E.	52		15. 1	49 7	
E. by N. ½ E.	62	06. 1		61. 7	
S. S. W. ½ W.	57		50. 3		26. 9
S. ½ E.	39		38. 8	03. 8	
		06. 1	144. 9	142. 4	26. 9
			6. 1	26. 9	
			138. 8	115. 5	

The whole Difference of Latitude is 138 $\frac{8}{10}$ South, the Departure 115 $\frac{5}{10}$ East.

Example 2.

The Courses being given in degrees, which often happens by reason of allowance for the Variation of the Compass, and in the like Cases.

Suppose a Ship bound to a certain Port sails North 34°, West 65 min. then North, 67°, West 56 min. then South, 78° West 48 min. then North, 23° East 54 min. then North 6°, East 36 min. and the Difference of Latitude and Departure required.

The Table.

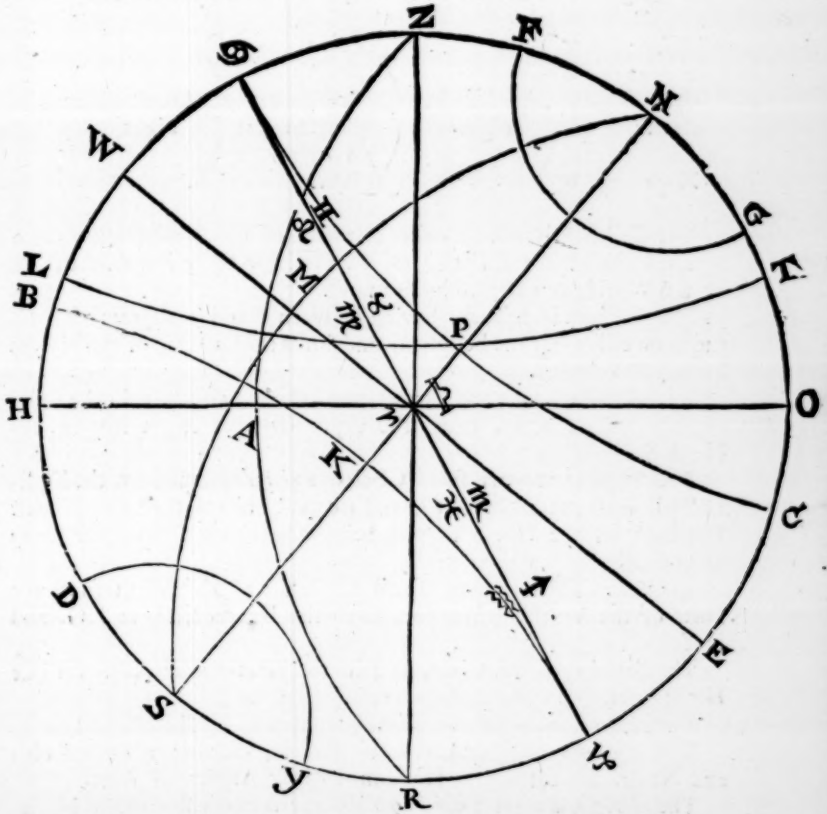
Courses.	Dist.	Diff. Lat. Nor.	Diff. Lat. Sou.	Departure East.	Departure West.
N. W. 34°	65	53. 9			36. 3
N. W. 67°	56	21. 9			51. 5
S. W. 78°	48		10. 0		47. 0
N. E. 23°	54	49. 7		21. 1	
N. E. 06°	36	35. 8		03. 8	
		161. 3	10. 0	24. 9	134. 8
		16. 0			24. 9
		1513.			109. 9

The whole Difference of Latitude is 151 $\frac{3}{10}$ North, the Departure 109 $\frac{9}{10}$ West.

Some

Some Neceſſary Aſtronomical Definitions.

THe Poles of the World, are two fixed Points in the Heavens oppoſite one to the other; the one viſible to us, called the *North Pole*, marked with the Letter N; the other not viſible to us, called the *South Pole*, marked with S.



The *Axis* of the World is a Line imagined to paſs from Pole to Pole, about which is performed the Diurnal Revolution.

The *Equinoctial* is a great Circle, 90 deg. diſtant from the Poles of the World, and divides it into the North and South Hemiſpheres, it is noted by the Letters E. W.

The *Ecliptick* is a great Circle interſecting the Equinoctial in two oppoſite Points, the beginning of *Aries*, and the beginning of *Libra*, and makes an Angle therewith of 23 deg. 30 min. It is divided into twelve Signs, each containing 30 deg. Which are as follows:

Aries	♈	Are Northern Signs.	*Libra*	♎	Are Southern Signs.
Taurus	♉		*Scorpio*	♏	
Gemini	♊		*Sagittarius*	♐	
Cancer	♋		*Capricornus*	♑	
Leo	♌		*Aquarius*	♒	
Virgo	♍		*Piſces*	♓	

The *Ecliptick* is noted by the Characters of the twelve Signs.

The Poles of the *Ecliptick* are two Points, 23° 30′ from the Poles of the World, repreſented by G and D.

The *Zodiack* is a Zone, having between 8 and 9 degrees of Latitude, on either ſide the Ecliptick, and limits the Latitude of the Planets in their Revolution.

The *Meridians* are great Circles interſecting each other in the Poles of the World, and cutting the Equinoctial at Right Angles, as N. M. S.

The *Tropicks* are two ſmall Circles, 23° 30′ diſtant from the Equinoctial, being parallel thereto, and are the Limits of the Sun's greateſt Declination; the North Tropick being marked with ♋ C, the South with ♑ B.

The *Poler Circles* are two ſmall Circles, 23° 30′ diſtant from the Poles of the World, being parallel to the Equinoctial, as F G. and D Y.

The *Zenith* is a Point imagined in the Heavens, directly over our Heads (*viz.*) 90° diſtant from the Horizon, as Z.

The *Nadir* is a Point diametrically oppoſite to the Zenith, as R.

The *Azimuths* are great Circles interſecting each other in the Zenith and Nadir, and cutting the Horizon at Right-Angles, Z. A. R.

The *Horizon* is a great Circle, 90° diſtant from the Zenith and Nadir, and divides the World into the Viſible and Inviſible Hemiſpheres, as H O.

The

The *Meridian* of a Place, is that Meridian which paſſeth by the Zenith and Nadir of the ſaid place.

Parallels of Altitude, or *Almicanters*, are ſmall Circles parallel to the Horizon, imagined to paſs through any degree of Altitude between the Horizon and the Zenith, as L. P. T.

Parallels of Declination or Latitude, are ſmall Circles parallel to the Equinoctial, and are called Parallels of Declination, with reſpect to the Sun or Stars, and Parallels of Latitude reſpecting the Earth.

Circles of Longitude in the Heavens are great Circles interſecting each other in the Poles of the Ecliptick, and interſecting the Ecliptick at right Angles.

The *Latitude* of a Star, is an Arch of a Circle of Longitude, contained between the Center of the Star and the Ecliptick, and is accounted either Northerly or Southerly.

The *Longitude* of a Star, is an Arch of the Ecliptick, contained between the Circle of Longitude of the Star, and the beginning of *Aries*, and is accounted according to the ſucceſſion of the Signs.

The *Declination* of the Sun or Stars, is an Arch of the Meridian, contained between the Center of the Sun or Star, and the Equinoctial, and is accounted either Northerly or Southerly.

The *Right Aſcenſion* is the Degree and Minute of the Equinoctial that comes to the Meridian with the Sun or Star.

Oblique Aſcenſion, is an Arch of the Equinoctial, contained between the beginning of *Aries*, and the Degree and Minute of the Equinoctial that riſeth with the Center of the Sun or Star.

Oblique Deſcenſion, is the Degree and Minute of the Equinoctial, that ſets with the Sun or Star.

Aſcenſional Difference, is an Arch of the Equinoctial, contained between the Right and Oblique Aſcenſion.

The *Amplitude*, is an Arch of the Horizon, being the Diſtance of the riſing or ſetting of the Sun or Star from the Eaſt and Weſt, and is accounted either Northerly or Southerly.

The *Latitude* of a place, is the height of the Pole above the Horizon, or the diſtance between the Zenith and the Equinoctial.

Longitude on the Earth, is an Arch of the Equinoctial, contained between the Meridian of the place, where Longitude is aſſigned to begin, and the Meridian of any other place, and is accounted Eaſterly.

The *Axis* of the World is a Line imagined to paſs from Pole to Pole, about which is performed the Diurnal Revolution.

The *Equinoctial* is a great Circle, 90 deg. diſtant from the Poles of the World, and divides it into the North and South Hemiſpheres, it is noted by the Letters E. W.

The *Ecliptick* is a great Circle interſecting the Equinoctial in two oppoſite Points, the beginning of *Aries*, and the beginning of *Libra*, and makes an Angle therewith of 23 deg. 30 min. It is divided into twelve Signs, each containing 30 deg. Which are as follows:

Aries	♈	Are Northern Signs.	*Libra*	♎	Are Southern Signs.
Taurus	♉		*Scorpio*	♏	
Gemini	♊		*Sagittarius*	♐	
Cancer	♋		*Capricornus*	♑	
Leo	♌		*Aquarius*	♒	
Virgo	♍		*Piſces*	♓	

The *Ecliptick* is noted by the Characters of the twelve Signs.

The Poles of the *Ecliptick* are two Points, 23° 30′ from the Poles of the World, repreſented by G and D.

The *Zodiack* is a Zone, having between 8 and 9 degrees of Latitude, on either ſide the Ecliptick, and limits the Latitude of the Planets in their Revolution.

The *Meridians* are great Circles interſecting each other in the Poles of the World, and cutting the Equinoctial at Right Angles, as N. M. S.

The *Tropicks* are two ſmall Circles, 23° 30′ diſtant from the Equinoctial, being parallel thereto, and are the Limits of the Sun's greateſt Declination; the North Tropick being marked with ♋ C, the South with ♑ B.

The *Poler Circles* are two ſmall Circles, 23° 30′ diſtant from the Poles of the World, being parallel to the Equinoctial, as F G. and D Y.

The *Zenith* is a Point imagined in the Heavens, directly over our Heads (*viz.*) 90° diſtant from the Horizon, as Z.

The *Nadir* is a Point diametrically oppoſite to the Zenith, as R.

The *Azimuths* are great Circles interſecting each other in the Zenith and Nadir, and cutting the Horizon at Right-Angles, Z. A. R.

The *Horizon* is a great Circle, 90° diſtant from the Zenith and Nadir, and divides the World into the Viſible and Inviſible Hemiſpheres, as H O.

The

The *Meridian* of a Place, is that Meridian which paſſeth by the Zenith and Nadir of the ſaid place.

Parallels of Altitude, or *Almicanters*, are ſmall Circles parallel to the Horizon, imagined to paſs through any degree of Altitude between the Horizon and the Zenith, as L. P. T.

Parallels of Declination or Latitude, are ſmall Circles parallel to the Equinoctial, and are called Parallels of Declination, with reſpect to the Sun or Stars, and Parallels of Latitude reſpecting the Earth.

Circles of Longitude in the Heavens are great Circles interſecting each other in the Poles of the Ecliptick, and interſecting the Ecliptick at right Angles.

The *Latitude* of a Star, is an Arch of a Circle of Longitude, contained between the Center of the Star and the Ecliptick, and is accounted either Northerly or Southerly.

The *Longitude* of a Star, is an Arch of the Ecliptick, contained between the Circle of Longitude of the Star, and the beginning of *Aries*, and is accounted according to the ſucceſſion of the Signs.

The *Declination* of the Sun or Stars, is an Arch of the Meridian, contained between the Center of the Sun or Star, and the Equinoctial, and is accounted either Northerly or Southerly.

The *Right Aſcenſion* is the Degree and Minute of the Equinoctial that comes to the Meridian with the Sun or Star.

Oblique Aſcenſion, is an Arch of the Equinoctial, contained between the beginning of *Aries*, and the Degree and Minute of the Equinoctial that riſeth with the Center of the Sun or Star.

Oblique Deſcenſion, is the Degree and Minute of the Equinoctial, that ſets with the Sun or Star.

Aſcenſional Difference, is an Arch of the Equinoctial, contained between the Right and Oblique Aſcenſion.

The *Amplitude*, is an Arch of the Horizon, being the Diſtance of the riſing or ſetting of the Sun or Star from the Eaſt and Weſt, and is accounted either Northerly or Southerly.

The *Latitude* of a place, is the height of the Pole above the Horizon, or the diſtance between the Zenith and the Equinoctial.

Longitude on the Earth, is an Arch of the Equinoctial, contained between the Meridian of the place, where Longitude is aſſigned to begin, and the Meridian of any other place, and is accounted Eaſterly.

Aſtronomical Problems uſeful in Navigation.

PROBLEM I

THE Suns Place and greateſt Declination given, to find its preſent Declination.

Example.

Suppoſe the Suns Place to be 20° 30′ of *Gemini*, the greateſt Declination is (always) 23° 30′; it's required to find the preſent Declination.

The Operation by the Logarithms.

As Radius	10.00000
To S. Suns greateſt Declination 23° 30′	9.60069
So is S. Suns Longitude 80° 30′ from *Aries*	9.99400
To S. Suns preſent Declin. required, which is Nor. 23° 9′	9.59469

By the Gunter.

The Extent from Radius S. 90°, to S. 23° 30′, ſhall reach from S. 80° 30′, to S. 23° 9′ the Declination required.

Note, The Suns Longitude is reckoned from the next Equinoctial Point; therefore if the Sun be in *Aries*, *Taurus*, *Gemini*, *Capricornus*, *Aquarius*, *Piſces*, the Longitude is accounted from *Aries*; but if in *Cancer*, *Leo*, *Virgo*, *Libra*, *Scorpio*, or *Sagittarius*, it is accounted from *Libra*.

Aries, *Taurus*, *Gemini*, *Cancer*, *Leo*, *Virgo*, are called Northern Signs; *Libra*, *Scorpio*, *Sagittarius*, *Capricornus*, *Aquarius*, and *Piſes*, are called Southern Signs. Conſequently if the Suns Place be in any of the firſt ſix, the Declination is Northerly; but if in any of the latter ſix, the Declination is Southerly.

PROB. II.

The Suns greateſt Declination, and preſent Declination given, to find its place.

Example.

The Suns greateſt Declination is 23° 30′: the preſent Declination, ſuppoſe to be 18° 30′ North increaſing, and the Suns place required.

By

By the Logarithms.

As S. of the Suns greater Declination 23° 30′	9.60069
To Radius	10.00000
So is S. of the present Declination 18° 30′ North	9.50147
To the S. Suns Place in the Ecliptick required, 52° 43′	9 90078

That is one Sign, (30° making a Sign) and 22° 43′ from *Aries*, because the Declination is North and increasing, that is, in 22° 43′ of *Taurus*; but if the Declination had been decreasing, it must have been accounted from *Libra*, and then it would have been 7° 17′ in *Leo*.

By the Gunter.

The Extent of the Compasses from the S. 23° 30′, the greatest Declination, to Radius S. 90°, shall reach from S. 18° 30′, the Suns present Declination, to the S. Suns Place 52° 43′ required.

PROB. III.

The Suns Place and greatest Declination given, to find the Right Ascension.

Example.

Suppose the Suns Place to be 10° 30′ in *Aquarius*, and the Right Ascension required.

The Operation by the Logarithms.

As Radius	10.00000
To Tang. of the Suns Longitude from ♈ 49° 30′	10.06850
So is Sc. of the greatest Declination 23° 30′	9.96230
To Tang. of Right Ascension required 47° 02′	10.03080

By the Gunter.

The Extent from Radius S. 90°, to Sc. of the greatest Declination 66° 30′, shall reach from Tang. Suns Longitude from ♈ 49° 30′, to Tang. Right Ascension 47° 02′ required.

Note, This Proportion gives the Right Ascension from the next Equinoctial Point; but it ought to be accounted from *Aries*, according to the order and succession of the Signs; and therefore in this last case 47° 02′ subtracted from 360°, gives 312° 58′ the Right Ascension required.

PROB.

PROB. IV.

The Latitude of a Place, and the Suns Declination given, to find the Suns Amplitude.

Example.

Suppose the Latitude 51° 32′ North, as the Suns Declination 15° 20′ North, and the Amplitude required.

The Operation by the Logarithms.

As Sc. of the Latitude 51° 32′	9.79383
To Radius	10.00000
So is S. of the Declination 15° 20′ North	9.42231
To S. Amplitude required, which is 25° 09′	9.62848

By the Gunter.

The Extent from Sc. of the Latitude 38° 28′, to the S. of the Declination 15° 20′ North, shall reach from Radius S. 90° to S. Amplitude 25° 11′ North required.

Note, If the Declination be Northerly, the Amplitude is Northerly; if the Declination be Southerly, the Amplitude is also Southerly.

PROB. V.

The Latitude of a Place, and the Suns Declination given, to find the Ascensional Difference.

Example.

Suppose in the Latitude of 51° 32′ North, the Suns Declination is 10° 45′ North, and the Ascensional Difference required.

The Operation by the Logarithms.

As Tang. 38° 28′ the Compl. Latitude	9.90008
To Radius	10.00000
So is Tang. 10° 45′ the Suns Declination	9.27842
To S. 13° 49′ the Ascensional Difference required	9.37834

By the Gunter.

The Extent from Tang. 38° 28′ to Tang. 10° 45′, shall reach from Radius S. 90°, to S. 13° 49′ required.

PROB.

PROBLEM. VI.

To find the Oblique Aſcenſion or Deſcenſion.

Firſt, Find the Aſcenſional Difference by the fifth Problem.

Secondly, The right Aſcenſion by the third Problem.

Then if the Suns Declination be Northerly, the Aſcenſional Difference ſubtracted from the Right Aſcenſion, gives the Oblique Aſcenſion, and added thereto the Oblique Deſcenſion. But if the Suns Declination be Southerly, the Aſcenſion Difference added to the Right Aſcenſion, gives the Oblique Aſcenſion, and ſubtracted, gives the Oblique Deſcenſion.

Note, That if the Aſcenſional Difference exceed the Right Aſcenſion, add to the Right Aſcenſion 360°, and then ſubtract the Aſcenſional Difference therefrom.

Or if both being added together, exceed 360°, the Exceſs is the Oblique Aſcenſion or Deſcenſion required.

PROBLEM VII.

To find the Time of the Sun's Riſing or Setting, and Length of the Day. Find the Aſcenſional Difference by the fifth Problem.

Which converted to Hours and Minutes of time, accounting for 15° one hour, and for every degree leſs than 15° 4′ of Time, and for every 15′ of Motion, 1′ of Time.

If the Suns Declination be Northerly, the Aſcenſional Difference added to ſix hours, gives the time of Sun ſetting, and ſubtracted, the time of Sun Riſing.

If the Declination be Southerly, contrarily the Aſcenſional Difference added, gives the time of Sun Riſing, ſubtracted, the time of ſetting.

The time of Sun ſetting doubled gives the length of the Day, the time of Sun riſing doubled the length of the Night.

Example.

In Lat. 51° 32′ North, ſuppoſe the Suns Declination 12° 15′ North.

The Aſcenſional Diff. 30° 27′, which reduced, is 2 hours 2 min. *fere*.

	Add	6	0
Time Sun Setting.		8	2
Time Sun Riſing.		3	58
Length of the Day		16	4
Length of the Night		7	56

PROB.

PROBLEM VIII.

The Latitude of the Place, the Suns Altitude and Declination given, to find the Azimuth.

Example.

In the Latitude 51° 32′ North, suppose the Suns Declination to be 20° 30′ North, the Altitude 47° 30′, and the Azimuth required.

The Rule.

Take the Complement of the Altitude, the Complement of the Latitude, and the Complement of the Declination to 90 degrees; add them together, and take the half sum; subtract the Complement of the Declination from the half sum, and take the Remainder; then set down the Complement Arithmetical of the Sings of the Comp'ement Altitude, and Complement Declination, and thereto add the Signs of the half sum and Remainder, half the Sum of these four Logarithms, is the Sc. of half the Azimuth required.

Note. If the Declination be South in North Latitude, or North in South Latitude, instead of taking the Complement of the Declination to 90°; there must be 90 deg. added thereto, and then proceed as before.

The Operation by the Logarithms.

S.	42°	30′	Compl. Altitude —— Comp. Arith.	0.17032
S.	38	28	Compl. Latitude —— Comp. Arith.	0.20617
	69	30	Compl. Declination.	
	150	28	Sum.	
S.	75	14	half Sum. ——	9.98541
S.	5	44	Excess of ½ Sum above Compl. Declination	8.99955
			Sum	19.36145
			Sc. of 61° 21′ —— Half Sum	9.68072
		61	21	

Which doubled 122 42, is the Suns Azimuth from the North required.

The Operation by Gunters *Scale.*

The Extent of the Compasses from Radius S. 90°, to the S. 24° 20′ the Complement of the Altitude, shall reach from S. 38° 28′ the Complement of the Latitude, to the S. of 24° 40′: then the Extent from S. 24°

S. 24° 40′ to S. 75° 14′ the half Sum, ſhall reach from S. 5° 44′ the exceſs of the half Sum, above the Complement Declination, to 122° 42′ (upon the Line of verſed Sines) which is the Azimuth required.

Example 2.

In the Latitude 51 deg. 32 min. North, the Suns Declination is 18 deg. 15 min. South, the Altitude 17 deg. 45 min. and the Azimuth from the North required.

The Operation of the Logarithms.

S. 72°	15′	The Compl. Altitude ——	Comp. Arith. 0.02118
S. 38	28	The Compl. Latitude ——	Comp. Arith. 0.20617
108	15	Declination, 90 deg. being added, becauſe South.	
218	58	Sum.	
S. 109	29	half Sum, Compl. to 180°, is 70° 31′ ——	9.97439
S. 1	14	Remainder —— —— —— —— ——	8.33292
			Sum 18.53466
			Half Sum 9.26733

Sc. of 79° 20′
79 20

Which doubled 158 40, is the Azimuth from the North required.

By the Gunter.

The Extent from Radius S. 90°, to the S. 72° 15′ the Complement Altitude, ſhall reach from the S. 38° 28′ the Compl. Latitude, to the S. 36° 20′: then the Extent from the S. 36° 20′, to S. 70° 31′ the Complement of 109° 29′ (the half Sum) to 280°, ſhall reach from the Remainder S. 1° 14′, to 158° 40′ (upon the Line of verſed Sines) the Azimuth required.

In South Latitude, the Operation is the ſame with the two precedeing Examples, only the Azimuth is found from the South.

After the ſame manner you may find the Azimuth of any Star.

PROBLEM IX.

The Latitude of the Place, the Suns Declination and Altitude being given, to find the hour of the Day.

Example.

In the Latitude 51° 32′ North, ſuppoſe the Suns Declination 23° 30′ North, the Altitude 36° 30′ in the Afternoon, and the Hour from Noon required.

The Rule.

Take the Complement of the Declination, the Complement of the Latitude, and the Complement of the Altitude to 90 deg. add them together and take the half Sum; ſubtract the Complement of the Altitude from the half Sum, and take the Remainder; then ſet down the Complement Arithmetical of the Sines of the Complement Declination, and Complement Latitude, and thereto add the Sines of the half Sum and Remainder; half the Sum of theſe four Logarithms, is the Sc. of half the time required in degrees and minutes.

The Operation by the Logarithms.

S. 66°	30′	Compl. Declination. ——	Comp. Arith. 0.03761
S. 38	28	Compl. Latitude ———	Comp. Arith. 0.20617
53	30	Compl. Altitude.	
157	28	Sum.	
S. 78	44	half Sum. ——	9.99155
S. 25	14	Remainder. ——	9.62972
			Sum 19.86505
	Sc. of	31° 07′ ——	Half Sum 9.93252
		31 07	

Which doubled 62 14 Which reduced into time makes 4 hours 9′, the time required.

But if it had been in the Forenoon, 4 hours 9 min. ſubtracted from 12 hours, leaves 7 hours 51 min. for the time.

If the Declination had been Southerly, all the Difference in the Operation is, That inſtead of taking the Complement of the Declination to 90 deg. there muſt be 90 deg. added thereto, as in the ſecond Example of the eighth Problem.

By the Gunter.

The Extent of the Compaſſes from Radius S. 90 deg. to the S. 66 deg. 30 min. the Complement of the Declination ſhall reach from the S. 38 deg. 28 min. the Complement Latitude to S. 34 deg. 40 min. then the Extent from the S. 34 deg. 40 min. to the S. of 78 deg. 44 min. the half Sum, ſhall reach from the Remainder S. 25 deg. 14 min. to 62 deg. 24 min. (upon the Line of Verſed Sines) required.

PROB-

PROBLEM. X.

Having the Latitude of the Place, the Suns Right Ascension, with the Right Ascension, Declination, and Altitude of a Star given, to find the Hour of the Night.

Example.

In the Latitude 51 deg. 32 min. North, on the *7th* of *January* 1679, the Suns Right Ascension is 20 Hours, the Right Ascension of the *Lions Tail* is 11 hours 32 min. the Declination 16 deg. 25 min. North, the Altitude 30 deg. 30 min. to the Eastward of the Meridian, the Hour of the Night required.

The Rule.

Take the Complement of the Stars Declination, the Complement of the Latitude of the Place, and the Complement of the Stars Altitude; add them together and take the half Sum, subtract the Complement of the Altitude from the half Sum, and reserve the Remainder; then set down the Complement Arithmetical of the Sines, of the Complements of the Stars Declination, and of the Latitude of the Place, and thereto add the Sines of the half Sum and Remainder: Half the Sum of these four Logarithms, is the Sc. of half the Stars distance from the Meridian.

The Operation by the Logarithms.

S. 73°	35′	Compl. Stars Declination —	Comp. Arith. 0.01808
S. 38	28	Compl. Latitude —	Comp. Arith. 0.20617
59	30	Compl. Stars Altitude.	
171	33	Sum.	
S. 85	46	Half Sum. —	9.99881
S. 26	16	Remainder. —	9.64596
			Sum 19.86902
	Sc. of 30°	40′ —	Half Sum 9.93451
	30	40	

Which doubled is 61 20 Which reduced into Time, gives 4 hours 5 minutes.

Note, If the Star be to the Eaſtward of the Meridian, then ſubtract the time produced by the Operation from 12 hours, (as in the Example foregoing); but if the Star be to the Weſtward of the Meridian, take the time produced by the Operation; to which adding the Stars Right Aſcenſion, and ſubtracting the Suns Right Aſcenſion, gives the Hour of the Night: but if the Stars Right Aſcenſion added to the Time forementioned, be leſs than the Suns Right Aſcenſion, add thereto 24 hours, and then ſubtract it, and it gives the Time of Night required.

4 Hours 5 min. ſubtracted from 12 hours, (becauſe the Star is to the Eaſtward of the Meridian) leaves 7 hours 55 min. to which adding the Stars Right Aſcenſion 11 hours 32 min. makes 19 hours 27 min. to which adding 24 hours, makes 43 hours 27 min. ſubtract the Suns Right Aſcenſion 20 hours, and there remains 23 hours 27 min. which being accounted from the preceding Midnight, (as it muſt always be) gives 11 hours 27 min. for the Time of the Night required.

Note further, If the Stars Declination be South, and the Obſervation made in North Latitude, or Declination North in South Latitude, in ſtead of taking the Complement Declination to 90 deg. there muſt be 90 deg. added to it, as hath been ſhown in the eighth and ninth preceding Problems.

The Operation by Gunter's *Scale.*

The Extent of the Compaſſes from Radius S. 90, to the S. of 73 deg. 35 min. the Complement of the Stars Declination, ſhall reach from the S. 38 deg. 28 min. the Complement of the Latitude, to S. of 36 deg. 40 min. then the Extent from S. 36 deg. 40 min. to S. 85 deg. 46 min. the half Sum, ſhall reach from S. 26 deg. 16 min. the Remainder, to 61 deg. 20 min. (upon the Line of Verſed Sines) required: With which proceed, as hath been directed, to find the Hour of the Night.

A RUTTER,

Containing the Courſes and Diſtances of ſome of the moſt Eminent Places on the Coaſt of England, Scotland, *and* Ireland, France, Spain, *and* Portugal. *As alſo the Thwart Courſes between the Eaſt Coaſt of* England *and* Holland, *the South Coaſt of* England *and* France, *and the Weſt Coaſt of* England *and* Ireland.

The Eaſt Coaſt of England *and* Scotland.

Leag.

From the *North Foreland* to the North-end of *Goodwin*, E. by S. — 01½
From the *North-Foreland* to *Kentiſh-Knock* N. by E. — 05
From the *North Foreland* to *Orfordneſs*, North, — 14
From the *Galloper* to *Orfordneſs*, N. N. W. — 10
From *Leyſtaff* to *Yarmouth*, North — 02
From *Yarmouth* to *Winterton*, N by W. — 02½
From *Cromer* to *Blackney*, W. N. W. — 03½
From *Blackney* to *Burnum* within the Sand, Weſt — 06½
From the *Spurn* to *Flamborough-Head*, N. N. W. — 09
From *Scarbrough* to *Whitby*, N. W. by W. — 05
From *Whitby* to *Tinmouth*, N. W. — 14
From *Tinmouth* to *Coquet-Iſland*, N. N. W. — 09
From the *Staples* to *Barwick*, W. N. W. — 03
From the *Staples* to St. *Abbs-Head*, N. W. — 07½
From *Aberdene* to *Boekneſs*, N. N. E. — 12
From *Boekneſs* to *Catneſs*, N. W. — 21

Thwart Courſes from England *to* Holland, *&c.*

From the *Foreland* to *Fluſhing*, Eaſt, Northerly, — 27
From the *Foreland* to the *Teſſel*, N. E. — 45
From *Orfordneſs* to the *Teſſel*, E. N. E. — 37
From the *Spurn* to the *Teſſel*, E. by S. — 59
From *Tinmouth* to the *Naze* of *Norway*, N. E. by E. — 102
From *Tinmouth* to *Holy Land*, Eaſt by South, — 106
From *Tinmouth* to the *Scaw*, E. N. E. — 135

From

From *Yarmouth* to the *Tessel*, E. N. E. —— 34
From *New-Castle* to *Maers-deep*, E. N. E. —— 83
From *Aberdene* to *Maers deep*, S. E. —— 113
From *Dover* to the *Maes*, N. E. by E. —— 34
From the *North-Fore-land* to the *Maes*, E. N. E. —— 32
From *New-Castle* to the *Fly*, E. S. E. —— 90
From *Scarbrough* to *Holy Land*, East, Northerly, —— 93

The South Coast of England.

From *Dover* to *Dungeneſs*, S. W. by W. —— 09
From *Dungeneſs* to *Fairlee*, W. S. W. —— 03½
From *Fairlee* to *Beachy*, W. S. W. —— 05
From *Beachy* to the *Owers*, West by South, —— 13
From *the Needles* of the *Wight* to *Portland*, W. S. W. —— 12½
From *Portland* to *Torbay*, West, Southerly, —— 12
From *Portland* to the *Start*, W. S. W. —— 16½
From the *Start* to the *Ramhead*, W. N. W. —— 08
From *Falmouth* to the *Lizard*, South by West, —— 04
From the *Start* to the *Eddy-Stone*, West, —— 08
From the *Start* to the *Lizard*, West by South, —— 20
From the *Lizard* to the *Lands-End*, W. N. W. —— 09
From the *Lands-End* to *Silly*, W. S. W. —— 08

Thwart Courses from the South Coast of England *to* France.

From the *Caskets* to *Blackneſs*, E. N. E. —— 48
From *Beachy* to *Blackneſs*, East, —— 20
From the *Isle of Wight* to *Diep*, E. S. E. —— 37
From *Dover* to *Diep*, South, —— 23
From *Portland* to *Seynhead*, S. E. by E. —— 38
From *Beachy* to *Struysart*, South, —— 24
From *Dover-Point* to *Struysart*, S. S. W. —— 33
From *Beachy* to the *Casquets*, S. W. by W. —— 23
From *Portland* to the *Casquets*, South by East, —— 13
From *Silly* to the *Casquets*, East, Southerly, —— 56
From the *Lizard* to *Garnsey*, East by South, —— 37
From the *Start* to *Seven Isles*, South by East, —— 24
From the *Lizard* to *Paul de Lyon*, S. E. by S. —— 29
From *Portland* to *Paul de Lyon*, S. W. by S. —— 40
From *Silly* to *Ushant*, S. E. by S. —— 37
From the *Lizard* to *Ushant*, South, —— 29

From

From the *Start* to *Uſhant*, S. W. by S. —— 40
From *Portland* to *Uſhant*, S. W. —— 53

The Weſt Coaſt of England.

From *Silly* to the *Cape* of *Cornwal*, N. E. —— 09
From the *Cape of Cornwal* to St. *Ives*, Eaſt by North, —— 06
From *St. Ives* to *Stoopert-Point*, N. E. by E. —— 09
From *Stoopert* to *Hartlond-Point*, N. E. by N. —— 09
From *St. Ives* to *Hartland-Point*, N. E. —— 18½
From *Hartland-Point* to the *Iſle of Londey*, North, —— 04
From the Weſt-end of *Londey* to *Biddiford*, E. S. E. —— 05
From *Londey* to the *Holms*, E. N. E. —— 20
From *Steepholm* to the River of *Briſtol*, N. E. by E. —— 12
From *Steepholm* to the *Naes*, W. N. W. —— 06½
From the *Naes* to *St. Gawens-point*, Weſt, Northerly, —— 17
From *Gawens-point* to *Milford-Haven*, N. W. by N. —— 04
From the Iſland *Scalm* to *Ramſey*, N. N. W. —— 01½

The Coaſt of Ireland.

From the South end of the *Saltees* to *Black-Rock*, N. E. by E. —— 02½
From the *Saltees* to *Tuſcar*, E. N. E. —— 05
From *Black-Rock* to the *Tuſcar*, E. N. E. —— 03
From *Green-Bay* to the Bar of *Waſhford*, North, Weſterly, —— 01½
From the *Bar* to *Waſhford* —— 02
From *Arkelo* to *Mizan-Head*, North by Eaſt, Eaſterly, —— 02
From *Nicaſtle* to the Point of *Brahe*, North, Weſterly, —— 02
From *Brahe-head* to the *Iſland Dalk*, North by Weſt, —— 02½
From *Dalk* to the Bar of *Dublin*, N. N. W. —— 02
From the Bar of *Dublin* to the City, W. S. W. —— 02½
From *Lambey* to *Carlingford*, North by Weſt, —— 13
From *Lambey* to the *South Rock*, N. N. E. —— 21
From the *North* and *South-Rock* to *Copeland Iſles*, N. N. W. —— 06½
From *Copeland-Iſles* to *Knockfergus-Bay*, N. W. —— 05
From *Lough-Swilly* to *Sheep-Haven*, W. S. W. —— 04
From the Iſland *Tore* to the *Iſles of Aaron*, S. W. by S. —— 09
From *Telling-Head* to *Kilbegh*, E. S. E. —— 05
From *Black-Rock* to *Ackle-Head*, S. E. —— 01
From *Slynehead* to *Galloway-Bay*, S. E. —— 09
From the Bay of *Galloway* to *Blaskeys*, S. W. by S. —— 21
From *Dingle-Haven* to *Skellocks*, S. W. by S. —— 07

From

From *Cape Dorſey* to *Mizan head*, E. S. E. —— 08
From *Sheeps-head* to *Beer-Haven*, North by Weſt, —— 02½
From *Beer-Haven* to the *Iſland Whiddy*, E. N. E. —— 08
From *Mizan-Head* to *Cape Clare*, Eaſt by South, —— 06½
From *Cape Clare* to *Old head*, Eaſt by North, —— 13
From *Old-head* to the Haven of *King-ſail*, North by Eaſt, —— 01½
From *Old head* to *Cork*, N. E. by Eaſt, —— 05
From *Cork* to *Waterford*, E. N. E. —— 19

Thwart Courſes from England *to* Ireland.

From *Groſholm* to *Waterford*, Weſt by North, —— 21
From the Rock *Maſcus* to *Tuſcar*, Weſt by North, —— 08
From the Rocks *Smales* to *Tuſcar*, N. W. by N. —— 10½
From the Lands End of *England* to *Tuſcar*, North by Weſt —— 40
From the Lands-End of *England* to *Waterford*, N. N. W. —— 40
From the Holy Hill in the Iſland of *Angleſey*, to the Bar of *Dublin*, Weſt by North, —— 18⅓
From *Rokol* to *Black Rock*, South by Eaſt, —— 80
From *Silly* to Cape *Dorſey*, North Weſt by Weſt, —— 56
From the Lands-End of *England* to Cape *Clare*, N. W. by W. —— 53
From *Silly* to Cape *Clare*, North Weſt, —— 46
From the Lands-End of *England* to *Oldhead*, North-Weſt, —— 45

The Coaſt of France, Spain, *and* Portugal.

From the *Fourn* to *St. Matthews-Point*, South South-Eaſt —— 04
From *St. Matthews-Point* to the Race of *Fountuay*, South by Eaſt —— 05
From *Gloyland* to *Groy*, Eaſt, —— 09
From *Gloyland* to *Bell-Iſle*, South-Eaſt by Eaſt, —— 12
From the *Weſt-Pens* to *Bell-Iſle*, Eaſt South-Eaſt, —— 21
From the Eaſt-point of the *Cardinal* to the Mouth of *Morbeam*, North North Weſt, —— 04
From the *Cardinal* to *Old Downs*, Eaſt North-Eaſt, —— 06¼
From *Armentiers* to the Weſt-end of *Uſe*, South by Eaſt —— 07
From the Eaſt-end of *Bell-Iſle* to *Uſe*, South Eaſt Eaſterly —— 16
From *Uſe* to the *Band* of *Oleron*, South Eaſt by Eaſt, —— 16
From *Bayon* to *John de Luz*, South by Weſt —— 04
From *John de Luz* to *St. Sebaſtians*, Weſt —— 08
From Cape *Martinhaco* to *Bilboa*, South South-Weſt —— 06½
From the Point of *Bilboa* to *Caſtro*, Weſt —— 05
From *Bilboa* to *St. Antony*, Weſt by North —— 10

From

From St. *Antony* to the Weſt Point of *Andero*, Weſt —— 05
From *Andero* to *Cape de Pinas*, Weſt, Northerly —— 38
From Cape *Pinas* to *Avilles*, S.S.W. —— 02½
From Cape *Pinas* to *Ribadeus*, S.W. by Weſt. —— 14
From Cape *Pinas* to *Ortegal*, Weſt by North, Weſterly —— 29
From *Siverus* to Cape *de Prior*, S. W. —— 05
From the *Groyn* to *Ciſarga*. Weſt —— 08
From *Ciſarga* to Cape *de Bylem*, S. W. by W. —— 12
From Cape *de Bylem* to Cape *Coriane*, S.W —— 02½
From Cape *Coriane* to Cape *Finiſterre*, South —— 02½
From Cape *Ortegal* to Cape *Coriane*, S.W. by W. —— 33
From St. *Sebaſtian* to *Bell-Iſle*, N.N.W. Northerly —— 80
From Cape *Martinchaco* to *Arcaſon*, N. E. Eaſterly —— 28
From Cape *Martinchaco* to *Uſe*, North, Eaſterly —— 60
From Cape *Pinas* to the Tower of *Cordan*, E. N. E. Eaſterly — 72
From Cape *Pinas* to *Bell-Iſle*, N. N. E. —— 80
From Cape *de Ortegal* to *Waterford* in *Ireland*, North —— 168
From *Ciſarga* to *Silly*, North by Eaſt —— 137
From Cape *Finiſterre* to *Port a Port*, S. S. E. —— 44
From Cape *Finiſterre* to *Avero*, South by Eaſt —— 53
From Cape *Finiſterre* to the *Burlings*, South —— 67
From *Port a Port* to *Avero*, South —— 10
From Cape *Montego* to the *Burlings*, S.W. —— 13
From the *Burlings* to *Roxent*, South by Eaſt, Eaſterly —— 16
From Cape *Pitcher* to Cape St. *Vincent*, South Eaſterly —— 29
From Cape *Finiſterre* to the *Lizard*, North North-Eaſt —— 153
From *Villa Nova* to Cape St. *Maries*, Eaſt by South —— 09
From Cape St. *Maries* to *Saltees*, E. N. E. —— 24
From Cape St. *Vincent* to Cape St. *Maries*, Eaſt —— 18½
From St. *Lucas* to the Point of *Cales*, S. E. —— 09
From *Cales* to the *Straits Mouth*, S. S. E. —— 10
From the Point of *Gibralter* to *Malaga*, N. E. —— 24
From *Malaga* to *Veles Malaga*, Eaſt Northerly —— 06½
From the Point of *Gibralter* to Cape *de Gat*, Eaſt by North —— 66
From Cape St. *Vincent*, to Cape *Cantin*, South —— 86
From Cape St. *Vincent* to Cape *de Geere*, South, Weſterly —— 133
From Cape St. *Maries* to the *Straits*, E. S. E. Southerly —— 45
From Cape St. *Maries* to Cape *Cantin*, South by Weſt —— 90

A Table of the Soundings coming into the Channel, reſpecting the Bearings and Diſtances from Silly, Uſhant, *the* Lizard, *&c. With the various ſorts of Ground.*

	Bearings.	Diſt.	Lat. D. M	Dep.	*The various ſorts of Ground.*
Silly.	South.	05	50 20	50	Branny ſand like ground wheat.
	S.S.E.	05	50.12	45	VVhite ſand mixed with ſhells.
	S.S.E.	62		50	Coarſe Owſe.
	E. S. E.	06		53	Coarſe ſand and fine red ſhells.
	E. by S.	08	50.12	58	Owſy ſand with Queen ſhells amongſt it.
	E. by N.	07	49.15	72	Owſy like Muſtardſeed with broken ſhells.
	E. by N.	15	48.50	72	Peppery ſand black and yellow.
	E. by N.	25	49.50	72	Black white and red Stones, with Owſe.
	E. N. E.	07	49.15	60	Some black ſand.
	E. N. E.	20	49.15	80	Rocky ground.
	E. N. E.	55		103	Fine white Sand.
	N. E. by E.	22	49.10	85	Sand and Owſe together.
	N. E. by E.	10	49.20	55	VVhite and red ſand mixed with ſhells.
	N. E. by E.	50	49.50	100	VVhite ſand with Owſe and Nits.
	N. E. by E.	25	49.50	64	Branny ſand with white and red ſhells.
	N. E. by E.	06	49.10	48	Black ſand.
	N. E. by E.	13	49.43	65	Branny ſand with ſome pieces of Shells.
	N. E.	10	49.40	65	Branny ſand, Herring bones, ſmall ſtones.
	N. E. by N.	10	49.20	57	Small red ſand.
	N. N. E.	100	49.47	102	VVhite ſand then entring on the Bank.
	N. by E.	18		68	Red ſand with black & white ſcollop ſhells
	North.	12	49.15	65	Broken ſhells with white and red ſand.
	North.	10	49.47	65	VVhite ſand on the Eaſt part of the Bank.
	N.N.W.	33	48.52	77	Red ſand and ſhells amongſt it.
	N.W. by N.	07	49.40	54	More ſhells, the *Lizard* N.E. diſt. 18 leag.
	N.W.	04	50.10	50	Branny ſand with black and broken ſhells.
	N.W.	07	49.47	60	Stony ground.
	N.W. by W.	04	50.25	61	Red and black ſand with gliſtering ſhells.
	N.W. by W.	2 1/2		44	Shells and ſand like points of Needles.
	W. by N.	13	50.25	63	Fine white ſand with a little Owſe.
	VVeſt.	21	50.08	66	Red and black ſand with gliſtering ſhells.
	VV. by S.	32	49.50	75	Fine white ſand ſmall and gliſtering ſhells.
	VV. by S.	3 1/2		40	Like broken VVheat or coarſe Bran.

Bearings

	Bearings.	Dist.	Lat. D. M.	Dep.	The various ſorts of Ground.
Uſhant.	North.	06	48.36	63	Full of ſmall Mace ſand.
	N. by E	18	48.15	80	Round ſtones mixed with Scollop ſhells.
	N.E. by N.	11		60	Small bearen ſhells and Hakes teeth.
	N. E.	29	48.50	85	Great and ſmall pieces of Cockle ſhells.
	N. E.	25	48.10	55	Gray and brown ſand with white ſhells.
	N. E. by E	07	48.30	68	White and gray Mace ſand.
	E. N. E.	14	48.36	68	Small Shells and Herring bones.
	E. by N.	25	48.30	85	White and gray ſand with ſmall red ſtones
	Eaſt.	18	49.0	70	Brannу ſand and ſome ſhells.
	Eaſt.	06	48.00	65	Red ſand, ſhells, things like Needles points.
	Eaſt.	15	49.15	70	Fine white ſand.
	Eaſt.	33	49.15	87	Dazling ſand like Barley ſtraw.
	Eaſt.	04	49.10	06	Full of Mace ſand and broken ſhells.
	E. by S.	04	48.56	63	Shells like Periwincles.
	E.S.E.	15	49.15	70	Shells gray and red pieces of Cockle ſhells
	E.S.E.	12	49.20	68	Groſs white ſand with ſhells.
	E.S.E.	08	49.05	64	VVhite ſhells and fine ſmall ſtones.
	E.S.E.	06		60	Hakes teeth, and ſhells like Oatmeal husks.
	S. E. by E.	20	49.15	72	Great ſtones like Beans and Peaſe.
	S. E. by E.	09	49.15	65	Sand and ſome ſhells.
	S. E. by E.	07	48.30	65	*James*'s ſhells.
	S. E. by E.	15	49.25	60	Small ſcollop ſhells with ſmall ſtones.
Lands-end.	North.	6½		50	Like husks of Oatmeal and ſmall ſtones.
	N. by VV.	01		53	Rocky ground.
Lizard.	N.E.	6½		48	Maſhy ſhells, and ſome ſcollop ſhells.
	N.E. by N.	10		53	Maſhy ſhells and Hakes teeth.
	N.N.E.	09		50	Maſhy ſhells like Oatmeal husks.
	N. by E.	15		58	Maſhy ſhells and Hakes teeth.
	North.	01		39	Stones as big as Beans, ſo 4 leagues off.
	N.W.	85		45	Gray ſand like Oatmeal-flower.
	N.VV.	03		43	Maſhy ſhells and ſmall ſtones.
	W.N.W.	0½		45	Small ſhingly ſtones and maſhy ſhells.
	W.by N.	04		40	White maſhy ſhells and white ſtones.
	W. by S.	30		41	Black gravelly ground with ſmall ſtones.
	N.E. by E.	12		57	Scollop ſhells.
	N.E. by E.	04		44	Great ſtones and rough ground.

	Bearings.	Diff.	Dep.	The various sorts of Ground.
Eddystone.	N. ½ mile.		35	Dirty brown sand and Hakes teeth.
	W. 2 miles		34	Dirty brown sand.
	S. 1 mile.		26	Fine sand, and within this 28 and 30 fathom
Start.	N. by E. N ly	8½	40	Like the Dust of a Grindstone, with Hakes teeth and shells.
	N. W. by W.	4½	43	
	N. W. by N.	03	38	Gravelly sand, small stones and shells.
	N. b W. W ly	12	38	Reddish shells mashed as if beaten in a Morter, white sand and Scollop shells.
	N. W. by W.	14	42	
Portland.	N. E. by E.	08	35	Small shingly stones as big as Pease.
	North.	08	40	Streamy ground with small stones.
	N. by E.	5½	33	The same with some black sand.
	N. E. by N.	11	41	Fine sand and scollop shells.
	N. N. E.	08	40	Fine sand, scollop shells, and small stones.
	N. E. by E.	2½	27	Shingly ground.
	W. N. W.	2½	20	Small stones.
Needles.	N. E. by E.	02	17	Great shingly ground.
	N. E. ½ E.	2½	19	Small shingly ground.
	N. E.	02	13	Rocky ground.
Body of the Isle of Wight.	N. by W.	3½	20	All the ground from *Albions* to the East end of the *Wight* is chalky, it makes dents in the Tallow, and nothing comes up but blown sand in rowls, which will crumble in your fingers.
	E. by N.	04	21	
	N. by E.	03	18	
	North.	03	18	
	N. by W.			
Dunnose.	W. by S.	04	16	Rough ground with some big stones.
	West.	04	21	A kind of sandy fishing ground.
	W. N. W.	08	33	Fishing-ground somewhat red, with stones.
	W. by N.	06	26	as big as Pease, and some as Beans.

Di-

Directions to ſail into ſome of the Principal Harbours on the Coaſt of *England*.

Directions to ſail into Silly.

Silly is divided into divers Iſlands; along the Weſt ſide lyeth a great many Rocks. There are ſeveral Channels through which to go in, but the Southermoſt, called St. *Mary's Sound*, is the beſt, being a fair opening of a Channel, but near the middeſt lye two ſunken Rocks, which in foul weather the Sea may be ſeen to break over; it is beſt to leave them on the Larboard ſide going in, and on the Starboard coming out; go ſo near the Starboard-ſhore, as that a Stone may be almoſt thrown on Shore; and when you are within the Point, luff up round and come to an Anchor in ſight of the Houſes; or when the Town is brought open with the Valley, leave two thirds of the Harbour on the Larboard-ſide.

Directions to ſail into Mounts-Bay.

If you are bound into *Mounts-Bay* with an Eaſterly Wind, keep not too near the *Lizard* ſhore, eſpecially at the *Manacles*, for without the *Manacles* there are ſunken Rocks. To avoid which, be ſure to keep ſo far off the ſhore, that all the Spire of the Steeple called *Keveron* may be ſeen above the Land; ſo ſhall you go clear of them unto the *Lizard* Point; from whence there lyeth a ledge of Rocks, which all ſhew themſelves at low water. About five leagues North-Weſt from the *Lizard* lyeth *Mounts Bay*, on the Eaſt ſide of which is a high Land, whereon ſtands a Caſtle called St. *Michaels Mount*; to the Eaſtward of which lyeth a great range of Rocks from the Land, a League into the Sea, whereof be ſure to be careful in dark Weather; from thence to the Southward towards the *Lizard*, the Coaſt is very full of Rocks, but lie not far off the ſhore.

To ſail into *Mounts Bay* coming from the *Lands-End*, or the *Lizard*, the ground is very clear all over, and fine Sand unto a mile of the ſhore, between 20 and 23 fathom.

To ſail into Foy.

To ſail into *Foy*, it is neceſſary to have at leaſt half flood; Run in amidſt the Channel between the two Points, and being come within, chuſe either ſide, but the moſt water is by the Weſt-Land, between the *Stakes* and the Square Steeple. Being come within the *Stakes*, (as

you

you come in by the Land) bear ſomewhat off preſently from the Weſt ſhore, almoſt into the midſt of the Channel neareſt the Weſt Shore, until you come before the Village that lieth on the Weſt ſide; where is a deep Dock, in which Ships that draw 16 foot may lie a-float at low water; four Ships may lie in the ſaid Dock.

To ſail into Falmouth.

Four leagues South-Weſt by South from *Foy*, lyeth *Deadmans-Head*, and two leagues to the Weſtward lyeth the Haven of *Falmouth*; upon the Weſt Point of the Haven of *Falmouth* ſtandeth a Caſtle upon the high Land, called *Pendennis*: In the entry neareſt the ſaid Weſt ſide, lyeth a great Rock above water, you may ſail in at either ſide of it; at the inner ſide of the Eaſt Point lye alſo ſome Rocks off the ſhore; on the Eaſt ſide is deepeſt water and moſt room, therefore in going in, give the Eaſt Point a large birth, there will be ſeven or eight fathom: keep the ſaid ſhore till you come within St. *Mauds* Caſtle; which when it bears Eaſt, there will be 16 or 17 fathom; but half the Harbour over towards *Smithick* is but four or five fathom: Obſerve in going in, to keep the *Manacles* open and ſhut on the Point of *Falmouth* Caſtle; and ſo it muſt be kept till you ſhut the Church over *Penny-Comquick*, into the North-Eaſt End of the *Smithick*, and ſo bear over to St. *Maudes*, and ride with the Caſtle Eaſt, laying one Anchor in 18 fathom, and the Weſtermoſt Anchor in four fathom, as ſhall ſeem convenient.

To ſail into Plimouth.

Seven leagues to the Weſtward of the *Start* lyeth *Plimouth-Sound*; at the Eaſtermoſt Point of the Sound lyeth a high round Rock called *Mawſtone*; between it and *Rambead* lyeth the ſaid Sound N. N. E. being round and deep.

A little to the Northward of *Rambead* is a fair Sand-Bay, where is good anchoring cloſe under the Land in 9 or 10 fathom. Two leagues South, a little eaſterly from *Rambead*, lies a Rock above water called the *Eddyſtone*; the Point of *Plimouth* lyeth from it North by Eaſt and N. N. E. diſtant about 4 leagues.

In the Sound by the Land of *Plimouth* lieth an Iſland called *Drakes* Iſland, which is faſt to the Weſt ſide, with a range of Rocks under-water; ſo that you muſt ſail along to the Eaſtward of it.

To

To ſail into Catwater.

To ſail into *Catwater*, Run in between the Iſland and the Point on the Eaſt ſide, in with the Land of *Plimouth*, till *Catwater* open on the Starboard; then go into the Eaſtward between the Point of *Plimouth*, and the Point on the Starboard-ſide, leaving moſt part of the Channel on the Starboard-ſide until you come within the Point; and anchor there right againſt the high ſteep Northern Land; there is at low water, with extraordinary Tides four and five fathom,

In ſailing into *Catwater*, be ſure to give a good birth to the Southern Point of the Entry, for there lies off the ſaid Point, a ledge of Rocks under water, about two Cables length off from the Land. Upon the Point of the Ledge lies a Buoy, where is about twelve foot water at half flood, which Buoy muſt be left on the Starboard-ſide going in, and when *Catwater* is altogether open, you may run in to the Eaſtwards, leaving in the Entry of the Harbor two thirds of the Channel on the Starboard ſide as aforeſaid, becauſe the South-ſhore is ſomewhat flat off, there lying a ſandy Bank, which reacheth to the ſecond Point of the South-ſhore of *Catwater*.

A little to the Eaſtwards of *Drakes-Iſland*, lies a Rock under water; upon which at low water it is not deeper than two fathom. To ſail within the Land, you may go to the Eaſtward or VVeſtward of the Rock as occaſion ſerves.

To ſail into Dartmouth.

Three or four leagues to the VVeſtward of *Torbay* lies the Haven of *Dartmouth*, which hath a narrow Entry lying in between two high-Lands: upon each ſide of the Haven ſtandeth a liltle Caſtle; on the VVeſt ſide is a Church on the high-Land, called St. *Patricks* Church. To ſail in coming from the VVeſtward, run in along by the VVeſter-Land ſo far to the Eaſtward, until the Key of the Village (on the Eaſt ſide of the Haven) be brought in the midſt of the Entry of the Haven between the two Lands; it is convenient to have the Boat ready (if any guſt of VVind ſhould come from the high-Land) to row in: Being come in, edge over to the VVeſt-ſide before the Brewhouſe, and anchor there in 10 or 11 fathom; or before the Village on the Eaſt ſide at pleaſure. At the Eaſt ſide lieth a ſunken Rock, to avoid which, ſteer in with St. *Patricks* Church, and do not bring the Village, which ſtandeth on the VVeſt-ſide of the Harbor, without the ſaid Church, but keep the outer Houſe of the ſaid Village in the Eaſt

ſide

ſide of the Chappel, and always in ſight without the Bulwark, on the North ſide by St. *Patricks* Church, then there is no danger of the Rock in the Range by the North Point. Between *Dartmouth* and the *Start* neareſt to *Dartmouth*, ſtandeth a white Spire Steeple called *Fackman*, which is a very good mark to know *Dartmouth* by,

To ſail into Torbay.

To go into *Torbay*, bring the Weſt Point, or the Berry, South by Eaſt, or S. S. E. from you; and anchor there in 7 or 8 fathom, where you ſhall be Land-lockt for a South and South-Weſt Wind. At the North-Eaſt end of the Bay is alſo a Tide Haven called the *Tormain*; before it is good Anchor-Ground in four or five fathom, according as is deſired to be nearer or farther from the Shore.

Directions for ſailing in at the Eaſt end of the Iſle of Wight *to* Portſmouth *Harbour, and alſo to* Hampton.

If you come from the Eaſtward with a Northerly Wind, bound into the *Iſle of Wight*, or *Portſmouth*; after you are come to the Weſtwards of the Shoal, called the *Owers*, hale in North-Weſt with St. *Hellens* Point; but do not hale too much to the Northwards, for there lieth a Bank of *Longſtone* Haven, to the Eaſtwards of the *Horſe*, that hath not above 13 foot on it at low water; but keeping of the Lead in 7 or 8 fathom, carrieth you clear without it, and will bring you to the South-Eaſt end of the Sand called the *Horſe*. St. *Hellens* Church being South-Weſt by Weſt from you, you may run in five fathom; and when you have brought the Weſtermoſt great white Patch, or Chalk, upon *Parch-down*, (which is the high Land to the Northwards of *Portſmouth*,) a Ships length to the Weſtwards of *South-Sea* Caſtle that ſtands upon the Beach, then you may luff up without fear: Being then to the Weſtward of the *Horſe*, and ſteering with that mark, it will lead you in alongſt the *Horſe* unto the Beach, and ſo into the Harbor of *Portſmouth*, keeping along cloſe by the Shore, until you come to the Town Walls end, and there you muſt bear off a little for a Flat that lyeth off from the Shore; this is for an Eaſterly Wind. But if you intend for *Stoaks-Bay*, when you have brought the Fire-Beacons on *Brown-Down*, which is to the W.N.W of *Hazle-wood* Point, within a Ships length without the ſaid Point, then you may bear to the Weſtwards along the out-ſide of the *Spit head*, which is the Shoal on the Weſt ſide of the entry of *Portſmouth* Haven.

If

If the Wind be Weſterly or Southerly, and you are coming from the Weſtward, and deſign for St. *Hellens*-Road, or *Stoaks*-Bay, from *Dunnoſe* to St. *Hellens*-Point, the Courſe is North-Eaſt by North, and N.N.E. but borrow no nearer to St. *Hellens* than ſix or ſeven fathom, for the Spit lies off a great way; but if it be clear weather that you may keep *Sand-down* Caſtle open of the *Culver-Cliff*, that Mark will lead without the Spit of the Point; and ſteering along in this Mark, until you open St. *Hellens* Church ſome two Ships length open of the Red Cliff within St. *Hellens*-Point, or *Port-Sea* Caſtle, to the Eaſtwards of *South-Sea* Caſtle, then are you clear of the Point, and may ſteer to St. *Hellens* Road North-Weſt, and having brought the Point South by Weſt, or between that and the South by Eaſt, you may anchor in 7 or 8 fathom very good ground.

Note, That you have no good clear ground all along the Iſland, untill you have opened St. *Hellens* Church as aforeſaid, and have brought the Point to bear from you S.S.W.

From St. *Hellens* Point to go between *No-mans-Land* and the *Horſe*, the direct Courſe in is North-Weſt by North, and North-Weſt; but you have no ſhoaling upon the South-Weſt ſide on *No-mans Land*, for you ſhall have 16 fathom, and the next caſt but 3; but at the *Horſe* you may ſtand in 10,9 or 8 fathom: If the ſtrong Tide be bent and ſmooth Water, you ſhall have a great waſhing of them by the overfall of the Water: But eſpecially on *No-mans-Land*, if it be clear Weather. There are very good marks to lead you in, which are as follows; Keep the two Windmills on the *Downs* on the *Iſle of Wight*, that they may be ſeen clear over all the Trees between you and them, but no more above them than even clear; and this Mark will lead you in, and ſo up along the Iſland without ſome middle ground that lyeth W.S.W. off the Point of *No-mans-Land*.

Alſo from St. *Hellens* Point (if it be clear weather that you can ſee it) there is a direct Mark, (*viz.*) a piece of an old Caſtle, heretofore called *Hazlewood* Caſtle, ſtanding on *Gilkeker* Point, (which of late is kept white) keep *Gosbere* Church and that both in one, or this Mark in the middle of the Wood about the Church, which ſheweth with a Valley like a Saddle, and ſo you may run directly in without fear. Or if the Wind be ſo that you are forced to turn it in, then you may turn the ſaid Mark within two ſails breadth of each end of the Wood. In the middle of the Channel is eighteen fathom water; and if you bring the ſaid Mark right under the North end of the Wood, you ſhall run in a Middle-Ground near the *Horſe*, that hath not above ten foot on it at low water, and hard ſand.

To ſail within the Wight *in thick Weather.*

To ſail between the *Main* and the *Wight* in thick Weather, borrow in ſix fathom of St. *Hellens*, and ſteer North-weſt by North, and N.N.W. from St. *Hellens* Point, till you have twelve fathom, and then ſteer more weſterly as you find the Depth; come no nearer *No-mans-Land* than nine or ten fathom; in that Depth you may keep along the *Wight*-ſide, if the Wind be Southerly; but if it be large, keep in fourteen or fifteen fathom, which is a good birth from both ſides; and ſo ſteer Weſt by South and W.S.W. as you find the Depth, until you come to *Cows*. Note, That being about *Stoaks-Bay*, there will be leſs water; if you go near to *Cows*, there you may anchor in twelve or 14 fathom, in the midſt of the Channel, where is good Oazy Ground.

Directions for Dover-*Road.*

The beſt Ground in *Dover*-Road is with the *White-Way*, to the North-Weſt of *Dover* Caſtle; or between that Hill that comes from St. *James*'s Church, which is a flat Steeple at the North-end of *Dover*-Town for a thwart Mark, and in what Depth you pleaſe, from ſeven to fourteen fathom. Thwart of *Foulſtone* in twelve or fourteen fathom is very good ground.

Directions to ſail from the North-Foreland *through the* Gulls *in the Night.*

If your Ground Tackle ſhould fail in the Night, riding at the *North-Foreland*, as very often hath happened, and you cannot weather the *Foreland*, weather the *North-ſand-head*; if you can but ſee the *North-Foreland*-Light, when that Light-houſe bears N. W. or North-Weſt by North, then bear over into eight or nine fathom, and being in that Depth, (ſteering to the Southward S.S.W.) you may be ſure it will carry you directly through with the *Brake*; but keeping your Lead carefully, and borrowing no nearer the *Brake* than five fathom, nor going without nine fathom, or nine and a half, as you have the Tide under you, and this Courſe will lead you through without Danger.

Directions for the North-end of the Goodwin, *for ſuch as Sail from the* North-Foreland *to the Southward in the Night.*

If you be at the *North-Foreland*, bound for the *Downs*, and that the Tides do fall out too early or too late to turn into the *Downs*, with the Wind at South-Weſt, or S.S.W. take the following Directions.

If

If it be in the Morning, before Day, then be sure to weigh Anchor in convenient time, to be at the *North-sand-head* at the turning of the Tide to the Southward. From the *Foreland* you may steer out with a Flood-Tide, South-East by East, and South-East, or keep the Light of the *North-Foreland* North-West by North; this Course will lead you out: But for the more certainty, be sure to keep the Lead well, and then you may borrow off and on with the aforesaid Winds in seven or eight fathom, and steering out in the aforesaid Course, you shall find the Depth suddenly change to fifteen or twenty fathom; then you may hale up close to the Southward along the Back of the *Goodwin*, the Easternmost side of which lies S. S. W. and N. N. E. twelve or fourteen fathom, and is not above a Saker-shot from the Sand; but if it be in the Day time, and the Wind blows so hard, that you cannot well Tack to turn through the *Gulls*, then the Marks to carry you out at the *North-sand-head*, is the flat Church upon the *Foreland* called St. *Peters*, a Ships Length to the Northwards of *Broad-stairs* Peer-head; or borrow upon the Sand by the Lead as aforesaid, and so taking the first of the Tide without the Sand, you may stand to the South-Eastwards till the *South-Foreland* bears West by South; then cast about and you shall weather the *South-sand-head*, and be in the *Downs*-Road before any other Ship that parted with you at the *Foreland*.

Not being willing to enlarge this Book to a greater Volumn, whereby the price should be augmented, I shall here conclude, referring those that desire farther Instructions for Piloting a Ship into any other Harbors on the Coast of *England*, *Scotland*, *France*, *Ireland*, *Flanders*, *Holland*, &c. to the *Coasting Pilot*, set forth by *J. Seller*; or the *Safeguard of Sailers*, and *Pilots Sea Mirror*; Books containing good Directions, and useful Sea-Charts, sold by *W. Fisher*.

FINIS.

Mathematical and Sea-Books, Printed for and sold by William Fisher, *Book-seller at the ancient Shop by the Postern on* Tower-Hill; *and* Robert Boulter *at the* Turks-Head, *and* Ralph Smith *at the* Bible, *in* Corn-Hill, *near the* Royal-Exchange, viz.

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